ANCHOR QEA

6650 SW Redwood Lane
Suite 333
Portland, Oregon 97224
Phone 503.670.1108
Fax 503.670.1128

November 4, 2011

Dana Bayuk
Oregon Department of Environmental Quality
2020 SW Fourth Avenue, Suite 400
Portland, Oregon 97201-4987

Re: Response to September 22, 2011 letter commenting on the May, 2011, Draft Groundwater Source Control Final Design Report, NW Natural Gasco Site

Project Number: 000029-02.26, 5A

Dear Mr. Bayuk:

NW Natural appreciates the DEQ comments on the constructible design presented in the May 2011 Draft Groundwater Source Control Measures Final Design Report. As DEQ is aware, NW Natural believes it is critically important to construct and operate source control across the entire frontage of the Gasco property as soon as feasible. Not only will the hydraulic containment system control groundwater contaminant transport to the Willamette River, it will provide critical data needed to evaluate technologies for the Gasco Sediment Engineering Evaluation/Cost Analysis (EE/CA) and is necessary prior to implementation of the sediment remedy. Construction of source control has been an Annual Priority Goal for the officers of the company every year since 2008. This means that NW Natural told its Board that it would construct source control in 2009, 2010, 2011, and now the officers need to tell the Board that again for 2012.

NW Natural disagrees with the DEQ preference to relocate the interceptor trench for the surficial fill water-bearing zone and the DEQ request to install the trench concurrently with the construction of the extraction system for alluvial groundwater. These revisions would require substantial time and resources and would lead to construction of a very costly element of the design out of sequence from the riverbank remedial work that will be done for the U.S.

Environmental Protection Agency (EPA). We continue to believe the configuration of the trench that was originally proposed maximizes hydraulic containment effectiveness and represents the alignment with the least impact to Siltronic and NW Natural tenant facility operations. We also believe that construction of the fill trench we proposed is premature at this stage of the overall project, especially because it is not necessary to support the sediment EE/CA, and the existing design can be built during the construction of the sediment and riverbank remedy.

Therefore, this letter provides a proposal to move this project into construction as soon as possible and includes NW Natural's initial response to DEQ's comments framed in two parts:

1. DEQ's comments on the extraction system for the alluvial water-bearing zone and NW Natural's proposal to expedite source control construction
2. DEQ's recommendations for the proposed interceptor trench for the surficial fill water-bearing zone

Alluvial Water-Bearing Zone:

NW Natural sees two general categories of DEQ comments on the design for the alluvial water-bearing zone. One category consists of comments related to design parameters and construction. The second category consists of comments that request additional studies and evaluations regarding post-construction operational effectiveness. We believe the first category of engineering comments on the Alluvium WBZ HC&C system can be quickly resolved and incorporated into a revised design, but the comments that request additional studies and analysis can be resolved in a more effective and efficient manner. After over four years of continuous study and design, NW Natural does not believe additional pre-construction studies are a prudent use of either time or resources.

NW Natural's long standing corporate goal of constructing source control as soon as possible remains unchanged, and we are concerned that resolving all of DEQ's comments using the approach proposed by DEQ could easily push construction of source control into 2013. We believe that source control is a time critical step in remediation at Gasco and respectfully request DEQ consider our alternate proposal of an iterative four-step approach that supports source control construction early in 2012. We believe that our goal of expedited source control construction is shared by DEQ.

Step 1 – Submit Revised Treatment System Design

The groundwater treatment system portion of the design will be revised to incorporate all of the DEQ comments associated with the treatment plant, including effluent quality. NW Natural will submit the revised treatment system design in November 2011 for expedited DEQ review and approval. This will enable NW Natural to place orders for long lead time components of the treatment system. DEQ declined the NW Natural request for expedited review and approval of the treatment system in our May submittal, but we believe it is reasonable to request it again because DEQ has now reviewed the proposed treatment system design in detail, and all of the DEQ comments related to the treatment system will be accepted and addressed. Treatment system construction will commence after the system design is approved by DEQ.

Step 2 – Submit Revised Design Report and Construct

NW Natural proposes to submit a Groundwater Source Control Construction Design Report in December that incorporates all of the DEQ comments related to the engineering aspects of the alluvial WBZ system design. Rather than complete the additional modeling and studies requested by DEQ, NW Natural proposes to build the system and collect empirical data on the system's actual performance during an interim operational testing period. As we have previously advised DEQ, Anchor QEA believes the groundwater MODFLW model has already been developed to the maximum extent possible to provide meaningful and useful information with respect to performance of the completed extraction system. We think our proposed approach has the double benefit of getting control of the Alluvium WBZ groundwater discharge sooner while providing much better data for the design of any modifications or additions to the system that may be required. We request expedited DEQ review and approval of the comprehensive design so that the infrastructure of the containment system can be constructed in early 2012.

Step 3 – Initial Operation

Short-term operational tests of the Alluvium WBZ extraction well system will be performed to obtain data needed to determine if hydraulic containment is being achieved. The tests will also be used to determine if contingency measures are needed to achieve hydraulic containment and to assess the seepage control effects in the river sediments. If necessary, groundwater can be pumped to the City of Portland until the treatment plant becomes operational and undergoes confirmation testing. If DEQ provides the requested expedited approval of the treatment system design, this contingency may be avoided.

Step 4 – Long-term Operation

The short-term testing data will be used to prepare a Groundwater Source Control Operations and Performance Monitoring Design Report. This report will identify any necessary modifications to the system, present the approach for periodically evaluating the effectiveness of the system, and contain contingency measures if needed to achieve hydraulic containment, such as installation of supplemental extraction wells. This report would also provide the information needed to inform the sediment remedy design process. NW Natural is fully committed to implementing any modifications required to attain the Remedial Action Objectives (RAOs) for the hydraulic containment system. After any necessary refinements are made to the system and the long term operational measures are approved by DEQ, the system will be activated.

NW Natural's proposal to install the extraction system, test the system, assess the hydraulic containment, and apply contingency measures, if needed, is consistent with EPA guidance in a *Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (EPA 600/R003 2008). Attachment A provides additional detail on the elements of the proposal related to the Construction Design Report, installation and testing of the alluvium WBZ extraction system, and preparing the Operations Design Report.

Surficial Fill Water-Bearing Zone:

On pages 11 and 12 of the September 22, 2011 comment letter, DEQ recommends that NW Natural redesign the alignment, sequence, and schedule to construct the Segment 1 Fill WBZ interceptor trench in the same timeframe and along a similar alignment as the Alluvium WBZ extraction well system. NW Natural has significant technical concerns related to DEQ comments on this design element. NW Natural continues to believe it is technically and operationally appropriate to construct the Fill WBZ riverbank trench when the riverbank remedy is performed for EPA. The DEQ directive in 2010 did not include any source control along the primary area of the trench, so NW Natural reasonably expected DEQ to accept this sensible phasing request. Four of DEQ's comments describe its primary reasons (page 12 of the September 22 letter) for making these recommendations. Those comments and our initial responses are as follows:

DEQ Comment. *Setting the trench back from the top-of-bank will reduce uncertainty regarding slope stability and intercept contaminated groundwater further upgradient of the river. Locating the trench on*

the uplands side of the extraction wells would also allow for performance/effectiveness monitoring using existing and proposed Fill WBZ monitoring wells.

NW Natural Response. NW Natural agrees that relocating the trench on the upland side of the extraction wells will reduce uncertainty regarding slope stability of the river embankment, but it will have other serious effects as described in the following:

- Relocating the trench further away from the river would create a wider zone of the Fill WBZ, where groundwater may not be captured by the trench and could potentially discharge to the river. This would have to be mitigated by other engineering measures that have not been considered to date.
- Relocating the trench in this manner would place the trench very close to Siltronic's wafer construction FAB. Because this new trench location has not been assessed from the geotechnical standpoint, a geotechnical investigation would have to be conducted to gather site-specific soil properties for a stability assessment. Siltronic has also expressed strong concerns related to the potential effects on Siltronics' FAB caused by ground vibration during construction of the trench. Considering the time that will be required for geotechnical work plan preparation, field investigation, stability assessment, vibration assessment, and report review, this process is estimated to take at least six months. However, coupled with DEQ's direction to construct the trench at the same time as the extraction wells, a minimum of six months would be added to the overall groundwater source control implementation schedule. Given the far higher flow rate of the alluvial WBZ (approximately 13 times that of the Fill WBZ), such a delay in source control implementation is clearly not justified from the standpoint of the amount of contaminated groundwater discharged to the river while we assess this recommendation. At the end of that six month process there is no guarantee that the geotechnical assessment will conclude that trench construction would be protective of the Siltronic FAB foundation or that Siltronic would approve the placement of the trench close to their FAB.

DEQ Comment. *Shoreline interferences are primarily associated with the FAMM leasehold. The FAMM leasehold represents approximately 600-feet of about 2,000-feet of shoreline. Upstream and downstream of the leasehold there appears to be working room. As such, it appears approximately 1,400-feet of trench does not have significant access and/or construction restrictions. Furthermore, the*

accessible 1,400-feet of trench alignment roughly coincide with the most significant contamination in the Fill WBZ near the shoreline.

NW Natural Response. The DEQ-recommended relocation of approximately 1400 feet of the trench also has serious implications with respect to constructability of the trench on Siltronic property, as described in NW Natural's response to the previous comment. On behalf of Siltronic Corporation, Maul, Foster & Alongi submitted a letter to DEQ on September 30, 2011, describing concerns about the feasibility of constructing the interceptor trench in the area recommended by DEQ.

DEQ Comment. *Postponing constructing the trench until sometime after the in-water project is initiated will significantly delay source control of the Fill WBZ. Constructing the trench before the riverbank project is initiated will achieve source control in the Fill WBZ years earlier for most of shoreline segments 1 and 2.*

NW Natural Response. The previous NW Natural responses have described why this trench relocation would have a negative impact on the river (from the standpoint of delaying implementation of source control in the Alluvium WBZ) and would create serious constructability issues (from the standpoint of the Siltronic wafer FAB foundation). This recommendation from DEQ is also confusing because it is inconsistent with DEQ's previous direction to evaluate hydraulic containment in the NW Natural portion of Segment 1 in the uplands Feasibility Study (FS). In a June, 2010 e-mail, DEQ directed NW Natural to postpone any groundwater source control in this portion of Segment 1 until the uplands FS was completed, which would have resulted in at least a two-year delay in the implementation of any groundwater source control in this area of the shoreline. DEQ's current recommendation to radically change the design of the interceptor trench because of the importance of source control of the Fill WBZ is inconsistent with DEQ's previous direction to postpone any groundwater source control in the NW Natural portion of Segment 1.

DEQ Comment. *Where mobile DNAPL occurs along the alignment, construction of the trench will promote DNAPL movement into the trench. Placing the trench near or on the riverbank could induce DNAPL movement towards the riverbank following NW Natural's recommendation. Aligning the trench near the extraction wells will induce DNAPL movement away from the riverbank and remove DNAPL from the fill in areas where downward vertical gradients between the Fill WBZ and Alluvium WBZ are greatest (i.e., above extraction wells).*

NW Natural Response. We respectfully submit that this is a flawed concept. Dense nonaqueous phase liquid (DNAPL) present in the fill between the trench and the shoreline could potentially migrate toward the river; therefore, our proposal to construct the trench as close to the riverbank as possible is designed to maximize capture of DNAPL in the Fill. The concept that extraction wells in the shallow and intermediate alluvium could induce DNAPL in the Fill to move away from the riverbank is not supported by any of the analysis or modeling done for the site. Review of the map on Figure 3-4a of the May 2011 Source Control Design Report shows that existing data indicates that potentially mobile DNAPL oil in the Fill zone is present specifically near borings B-57, B-58, and MW-16, which represent a small fraction of the length of the total trench alignment. The maps and associated cross sections show that most of the DNAPL in the fill near the shoreline is tar—not mobile oil. Therefore, realigning the entire Segment 1 portion of the trench to mitigate the potential drainage of mobile DNAPL in such a small portion of the Fill zone is not technically justified.

These four technical concerns are presented in addition to the compelling logical argument of not constructing a riverbank trench prior to completing riverbank remediation for EPA, and the reasonable request to sequence construction of the Fill WBZ containment after the primary hydraulic zones have operational source control in place.

Suggested Next Steps

Attachment B contains a table that provides NW Natural's initial responses to the DEQ comments. Attachment B contains three tables which divide agency comments into three groups. The Category 1 Table provides NW Natural responses that will be addressed in the proposed Groundwater Source Control Construction Design Report. The Category 2 Table provides NW Natural responses on those items that are proposed to be addressed in the Groundwater Source Control Operations and Performance Monitoring Design Report. The Category 3 Table provides NW Natural responses on those items that NW Natural is not currently prepared to agree with and require further discussion with DEQ.

As you will note in Appendix B, NW Natural is proposing to incorporate over 90 percent of agency requests in the proposed Construction Design Report, and most of the remaining requests will be incorporated in the proposed Operations Design Report. We recognize that some technical discussions will be necessary to resolve this proposed design approach and are prepared to meet at DEQ's convenience. As stated in the Appendix B response to comments, NW Natural agrees to most of the DEQ requests on redesign of the monitoring network and the

performance monitoring program with the understanding that DEQ supports the proposed process for completion of source control design in an expedited manner. NW Natural would appreciate a decision from DEQ on this proposed design approach within two weeks. At this stage of the source control design process, NW Natural urges DEQ to select the path forward that leads to source control construction as soon as possible.

Respectfully submitted,

John E. Edwards, RG, CEG
Anchor QEA, LLC

Attachments
Attachment A: Additional Alluvium WBZ Proposal Details
Attachment B: NW Natural Responses to DEQ and EPA Comments, Categories 1, 2, and 3

cc:
Patty Dost, Pearl Legal Group PC
Tom McCue, Siltronic Corporation
Alan Gladstone and Hanne Eastwood, Davis Rothwell Earle and Xochihua
James Peale, Maul, Foster, Alongi
Jim Anderson, DEQ
Sean Sheldrake, EPA
Lance Peterson, Camp Dresser McKee
Mike Crystal, Sevenson Environmental Services
Carl Stivers, Anchor QEA
Ryan Barth, Anchor QEA
John Verduin, Anchor QEA
Mike Riley, Anchor QEA

Attachment A
Additional Alluvium WBZ Proposal Details

1.1 Submit Revised Groundwater Source Control Construction Design Report

NW Natural proposes to prepare the Groundwater Source Control Construction Design Report as the next step in the design process. This report would address most of the comments and requests made by the agencies as described in the September 22, 2011 DEQ comment letter and attachments. DEQ's September 22 letter and attachments contained about 120 agency requests for additional work related to the May 2011 Gasco groundwater source control final design report. More than 90 percent of the agency requests are related to the review of the design of the physical components of the extraction wells, performance monitoring program, groundwater treatment system, interceptor trench, and DNAPL monitoring plan. Also included were numerous requests for the addition of information and revisions to the figures and tables. NW Natural's commitment to address these requests in the Groundwater Source Control Construction Design Report and our initial responses on those requests are provided in the Category 1 Table in Attachment B.

In cooperation with DEQ, NW Natural has made numerous adjustments to the modular finite-difference flow (MODFLOW) model that has been used to prepare the current design of the Alluvium WBZ extraction system. We propose to provide additional documentation of the model changes, as requested by DEQ in the September 22 comments. We also propose to run the model with input from recent testing of the pilot extraction wells PW-7, PW-8, and PW-9, as requested by both DEQ and EPA. The requested documentation of model changes and the model results from the testing of PW-7, 8, and 9 will be included in the Construction Design Report.

Note that we plan a complete review of the extraction well screen slot size, annular backfill, and screen length design, as requested by the agencies. We also propose to complete GeoProbe borings to obtain grain size samples at each of the Upper Alluvium extraction well locations to enable site-specific screen design, as recommended by DEQ. We also propose to add the monitoring wells and piezometers recommended by DEQ.

However, approximately 10 percent of the agency requests require additional groundwater modeling and other analyses for the purpose of predicting the hydraulic performance of the completed extraction system to enable potential revision of the current extraction system well

spacing, screen depth, and system operational parameters. It is our position that additional predictive model runs (to evaluate the current design of the Alluvium WBZ extraction well spacing) and screen depths (for the currently proposed extraction wells) will not be useful because the aquifer parameters at future extraction well locations cannot be accurately determined without installing and testing the wells. Therefore, using the MODFLOW model to predict the future behavior of the completed extraction system would not provide more reliable information on the hydraulic behavior of the system than we have already obtained from previous model runs. The same argument applies to DEQ's requests to establish hydraulic control parameters for the groundwater control wells and requested prediction of ΔH at the planned control wells.

The findings from the recent testing of the pilot extraction wells has shown that the current extraction system well spacing and screen depths are capable of attaining hydraulic containment of the Alluvium WBZ. There are a total of 22 Upper and Lower Alluvium extraction wells in the current design. Five of the proposed extraction wells have already been installed and tested: PW3-118, PW7-93, PW8-39, PW8-68, and PW9-92. This means that 17 planned extraction wells have not been installed or pump tested. If we were to conduct predictive modeling of the system, as requested by DEQ, we would have to make assumptions about the aquifer properties at each of the 17 extraction well locations that have not yet been installed. We would also have to make assumptions about the aquifer properties at the future locations of the proposed control wells. Therefore, the results of the modeling would be limited by our inability to accurately predict aquifer properties at those locations. This means that we would not be able to rely on information from the model runs for the purpose of redesigning extraction well spacing or depth, and regardless, we would have to calibrate and rerun the model once all of the wells are installed and tested.

Therefore, at this stage of the design process, it is our position that the most effective way to assure that the final system is capable of complete hydraulic containment is to install the entire extraction well system and conduct detailed pump tests. The pump test work plan would be included in the Construction Design Report. The work plan would include protocols for pump testing the new extraction wells individually to determine aquifer parameters and then successive tests of the completed extraction system.

In the Construction Design Report, it will be made clear that the extraction system and pipeline system is designed to accommodate the addition of extraction wells if the pump tests conducted in Step 2 indicate that contingency measures are needed to achieve hydraulic containment.

1.2 Install and Test the Alluvium WBZ Extraction System

During Step 2 we would install all of the planned extraction wells using the well spacing and screen depths that are in the current design. All of the monitoring wells and piezometers would also be installed. Following installation of the 17 extraction wells, each well would be individually pump tested to determine the aquifer properties for that portion of the aquifer. The Tar-specific Green Optical Screening Tool (TarGOST) borings would also be completed for the purpose of establishing baseline conditions for the presence of DNAPL.

The aquifer parameters from those individual extraction well tests would be incorporated into the MODFLOW model. After all of the extraction wells and monitoring wells have been installed and hooked up to the pipelines and control systems, a series of system-wide pump tests would be conducted with simultaneous pumping of all wells in the system. The protocols to be followed during those tests will be provided in the Construction Design Report.

If we receive expedited review and approval of the revised Treatment Plant Design, we would attempt to construct the treatment plant in time to treat the groundwater from these tests. The groundwater from these tests would ultimately be discharged to the Publicly Owned Treatment Works (POTW) under an extension of the current POTW permit. Initial discussions with the City of Portland, Bureau of Environmental Services (BES) have occurred, and it is probable that the permit will be extended. Upon completion of the tests, the extraction system would be shut down, pending completion of Step 3 and receipt of agency approval for permanent operation of the source control system.

1.3 Submit Groundwater Source Control Operations and Performance Monitoring Design Report

The findings from Step 2 testing of the completed extraction system would be used to calibrate the model using real-time water level data from the river, the upland monitoring wells, the river piezometers, and the pumping rates at the extraction wells. The calibrated and refined MODFLOW model would then be used to assess the degree of upland capture that the system is capable of achieving. The data would be evaluated to determine if contingency measures are

needed to enable the system to achieve complete upland containment of groundwater in the Alluvium WBZ. A possible contingency measure would be installation of an additional extraction well or wells. Such a contingency might also be necessary to reduce hydraulic gradients in the Upper Alluvium for the purpose of reducing the potential for DNAPL mobilization. The information from these tests would be used to balance the pumping rates needed for upland hydraulic containment with the pumping rates needed to achieve offshore seepage control for the sediment remedy. NW Natural would work with DEQ and EPA to develop protocols that satisfy both agencies and balance upland source control and sediment remedy goals.

The Groundwater Source Control Operations and Performance Monitoring Design Report would include needed system operational procedures for the physical operation of the system. It would also contain protocols for system performance monitoring, including the parameters for monitoring hydraulic containment. The report would contain system maintenance plans, schedule, and procedures.

Attachment B
Gasco Source Control Design Report
Category 1 Responses to DEQ and EPA Comments

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
1 **DEQ General Comments, pages 6 and 7** Regarding the last two bulleted items, given source control design is ongoing and the uplands FS has not been initiated, DEQ believes a reasonable goal for coordinating source control design and FS planning is to complete the Risk Assessment and final SCMs design within a similar timeframe. NW Natural should discuss sequencing and implementation of groundwater SCMs with the final remedy in the Draft Final Groundwater SCMs Design, especially with regard to the former Tar Ponds area. Currently, DEQ understands NW Natural will be developing a comprehensive upland DNAPL management evaluation in the uplands FS. **General Comments** DEQ's general comments on the Revised Interim Design Report are provided below. The general comments are intended to clarify the RAOs for groundwater source control and the SCMs design information, evaluations, and modifications NW Natural needs to provide to address the key issues for redesigning the HC&C system along the portion of Segment 1 where DNAPL occurs. DEQ's specific comments on the Revised Interim Design Report are attached. Besides DEQ, the EPA and the U.S. Army Corps of Engineers (ACOE) reviewed the Revised Interim Design Report. The EPA's comments are attached, and a copy of the ACOE's	Please refer to NW Natural Category 3 responses, item 1. Yes, this sequencing will be discussed in the Construction Design Report.

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
comments is also provided. NW Natural should note, EPA and DEQ share many comments. As such, NW Natural should closely review the attachments so all comments are considered during preparation of the Draft Final Groundwater SCMs Design. DEQ understands NW Natural proposes the Alluvium WBZ HC&C system as an element of the in-water sediment project. Based on this understanding DEQ believes EPA's June 29, 2011 comments are directly applicable to the Revised Interim Design Report. In addition to the reviews completed by the ACOE, EPA, and DEQ, and given the Revised Interim Design Report includes the northern portion of the Siltronic Property, DEQ understands Siltronic provided NW Natural with comments which were fully incorporated into the document prior to its being issued to DEQ. **Groundwater SCMs Remedial Action Objectives** The source control RAOs listed in Section 1.2 reflects the Groundwater/DNAPL FFS and DEQ's March 21, 2008 comments on the same. The RAOs included in the Groundwater/DNAPL FFS, as modified by DEQ's March 21st letter do not directly apply to the source control planning and design process which came out of the dispute resolution settlement. The focus of source control is now on the groundwater pathway. The RAOs for groundwater source control are to prevent migration of contaminated groundwater from	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
the uplands to the Willamette River along shoreline segments 1 and 2 in a manner that minimizes DNAPL mobilization resulting from groundwater SCMs along the portion of Segment 1 where DNAPLs occurs. In the first paragraph at the top of page 3, NW Natural implies the performance monitoring plan in the Revised Interim Design Report addresses DNAPL migration to the river. This is not the case. The performance monitoring program is intended to evaluate HC&C system performance through monitoring its hydraulic influence, trends in groundwater data, and DNAPL movement. As discussed above, further evaluation and design of the vertical barrier (i.e., the DNAPL SCM intended physically prevent DNAPL from migrating to the river) has been deferred to the uplands FS. Consistent with DEQ's determination documented in the March 26, 2010 commenting on the Interim Design Report and agreements reached during dispute resolution, NW Natural will carry the vertical barrier[1] forward into detailed analysis in the uplands FS as a remedial action alternative for RAO #1. DEQ's March 26th should be referred to for additional information on the status of the vertical barrier.	

[1] The vertical barrier to be carried into detailed analysis in the uplands FS will be 625 feet long with a bottom depth corresponding to -60 feet City of Portland datum and constructed using sheet-pile methods.

Attachment B
Gasco Source Control Design Report
Category 1 Responses to DEQ and EPA Comments

	Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
	NW Natural should revise the RAOs in the Draft Final Groundwater SCMs Design consistent with these comments.	Yes, we will address revision of the RAOs in the Construction Design Report.
2	**DEQ General Comments, Page 7, 8, 9** **Long-term Operation and Effectiveness of the Hydraulic Control and Containment System** The Alluvium WBZ SCM is a well-based HC&C system designed to reverse hydraulic gradients from the river towards the uplands. According to NW Natural gradient reversals will be achieved using a Programmable Logic Control (PLC) that monitors the gradient differential between uplands groundwater and the river at selected control wells. Each extraction well will be equipped with variable frequency drive (VFD) pump which is interfaced with the PLC to change the pump speed and pumping rate concurrently with groundwater elevation changes caused by river stage fluctuations. DEQ believes the long-term effectiveness of the Alluvium WBZ SCM is dependent on: • The capacity of the HC&C system to continuously pump groundwater on a year-round basis at the rates required to achieve and maintain gradient reversals in the Alluvium WBZ to prevent contaminated groundwater in the uplands along	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
segments 1 and 2 down to the top of the CRB from migrating to the Willamette River; and • Minimizing the potential for DNAPL migration to occur as a result of operating the HC&C system along the portion of Segment 1 where DNAPL occurs. The Revised Interim Design Report does not include contingencies. Given this information and the size, cost, and performance/effectiveness objectives of the HC&C system, factors that could limit the system's pumping capacity should be identified, fully evaluated, and addressed before finalizing the groundwater SCMs design. Based on review of the Revised Interim Design Report and the results of the Segment 2 pilot extraction well tests, the potential affect of the following factors on the long-term effectiveness of the HC&C system should be further evaluated: • NW Natural's presumption that groundwater level changes and gradient changes observed between pre-pumping and pumping periods during Segment 2 pilot well tests are due entirely to the influence of extraction wells (e.g., influence of river stage fluctuations are considered negligible), which could lead to overestimating the effectiveness of the HC&C during times of the year; • Data from the Segment 2 PLC and VFD field tests that suggest	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
the total extraction rate of the HC&C system may be greater than 260 gpm determined from numerical simulations, including; – Projected groundwater inflows into the lower Alluvium WBZ and upper Alluvium WBZ of 305 gpm (upper Alluvium WBZ) and 650 gpm (lower Alluvium WBZ) above the aquitard, implying individual upper Alluvium WBZ extraction wells need to sustain an average pumping rate of 30.5 gpm, and each extraction well in the lower Alluvium WBZ must pump at an average rate of 65 gpm. – The average pumping rates for lower Alluvium WBZ extraction wells PW-7-93, PW-8-68, and PW-9-92 equipped with VFDs was 50 gpm, 67 gpm, and 34 gpm during a 72-hour pumping period. – Groundwater level data from certain uplands monitoring wells constructed in the lower Alluvium WBZ which showed little response during pilot extraction well testing (e.g, MW-21-116). • The potentiometric surface of the Alluvium WBZ which seasonally occurs near the base of the fill unit (i.e., top of the upper silt unit); and • Heterogeneity of the upper Alluvium WBZ and extraction well	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
design factors that could contribute to excessive drawdown in extraction wells during HC&C operation. DEQ believes the factors listed above would have a maximum negative impact on the operation and performance of upper Alluvium WBZ extraction wells. The Draft Final Groundwater SCMs Design should fully evaluate these factors by: • Using the MODFLOW model updated to include the results of Segment 2 pilot extraction well tests, to simulate HC&C system operation under seasonal operating extremes of groundwater levels and river stage. The results of the simulation should be evaluated in terms of the available drawdown for each extraction well included in the Revised Interim Design Report. The pump placement elevation(s) implied by the schematic design drawings provided in the revised interim SCMs design (see figures 3-7a and 3-7b) should also be utilized in the evaluation. The specific capacities determined for existing extraction wells should be incorporated into the evaluation for purposes of comparison. • Reevaluating extraction well designs, including screen radius, length, depth of placement, slot-size, and filter-pack gradations of existing extraction wells in the context of what is now known about the material properties of the upper Alluvium WBZ.	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
Well efficiencies determined from the pumping tests completed at the site to date should be used in the evaluations. In addition, the designs of the proposed extraction wells should be based on location-specific information (e.g., sieve analyses collected during drilling from the depth interval of screen placement at each extraction well location).	Yes, we will do these evaluations for the Construction Design Report, and we plan to obtain depth-specific soil samples for grain size analysis prior to design and construction of the Upper Alluvium extraction wells.
The results of transient MODFLOW simulations and the extraction well design evaluation(s) should be included in the Draft Final Groundwater SCMs Design. The simulations and well design evaluations might identify operational scenarios which could prompt modifications to the HC&C system (e.g., addition of extraction wells). The draft final SCMs design document should discuss these scenarios in terms of potential future contingency measures.	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses. Yes, in the Construction Design report we will identify the types of contingency measures that would be implemented, such as installation of additional extraction wells.
DEQ's request for transient groundwater simulations made here is consistent with the March 26, 2010 letter which indicates the HC&C system, "…will need to accommodate a dynamic system influenced by seasonal changes in natural recharge, river stages and tidal influence," and recommends that, "…NW Natural run the MODFLOW model in a transient state to verify the model's ability to simulate changing groundwater flux and hydraulic head conditions	

	Category 1 **Agency Requests to be Addressed in Construction Design Report**	**NW Natural Response**
	resulting from these influences." Furthermore, DEQ's January 11, 2010 letter commenting on the Segment 2 Test Plan informs NW Natural that, "…final data interpretations, conclusions, and analysis, including the results of numerical modeling, should be fully integrated in the HC&C system final design."	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.
3	**DEQ General Comments, Page 9** **Uplands Source Control and the In-water Sediment Remedy.** Groundwater SCMs are being designed to prevent migration of contaminated groundwater from the uplands to the Willamette River by controlling and containing groundwater in the Fill WBZ and Alluvium WBZ. In addition, NW Natural proposes the Fill WBZ and Alluvium WBZ SCMs as elements of the in-water sediment remedy being overseen by EPA. The Revised Interim Design Report does not discuss how the long-term sediment remedy objective of achieving and maintaining gradient reversals under the river will be reconciled with the source control objective of minimizing DNAPL movement. The Draft Final Groundwater SCMs Design should discuss this scenario fully, including the operational priorities of the HC&C system in the context of the in-water remedy. For example, in the absence of an in-water remedy,	Yes, the Construction Design Report will address this issue. The quantitative criteria for operating the system will be developed in the Operations Design Report, following construction and testing of the system.

	Category 1 **Agency Requests to be Addressed in Construction Design Report**	**NW Natural Response**
	the operational and performance objectives of the HC&C system are dictated by uplands groundwater source control. NW Natural should discuss how the operational objectives of the system might change during and after implementation of the in-water remedy. NW Natural should note that DEQ's comment regarding the long-term operation/effectiveness of the HC&C system applies here as achieving gradient reversals for the in-water project would require greater extraction rates than for source control alone.	Yes, see response to previous request.
4	**General Comments, Pages 9 and 10** **Performance Monitoring** **Monitoring Well Network.** NW Natural indicates, "The network of existing shoreline monitoring wells was carefully evaluated to determine which wells have suitable location and screen elevation to be useful to assess the capture performance of the extraction well system." Table 3-4 identifies the installations NW Natural believes are necessary to assess capture for the entire HC&C system, including whether they will serve as groundwater elevation data measuring points or control wells for HC&C system operation; and the current and proposed schedule for collecting groundwater samples for analysis. DEQ does not approve sections 3.2.2.5.1 and 3.2.2.5.2 of the revised	

Category 1 **Agency Requests to be Addressed in Construction Design Report**	**NW Natural Response**
interim design as there is no discussion of the data collection objectives for the performance monitoring well network or the criteria NW Natural proposes to use to "assess capture performance of the extraction well system." These sections should be revised to: • Provide clear descriptions of the data collections objectives of the performance monitoring well network; • Discuss the piezometers, observations wells, and monitoring wells in the proposed performance monitoring well network in terms of the data collection objectives; • Identify the specific data collection objectives of each well; • Propose criteria for assessing the performance and effectiveness of the HC&C system and making adjustments to system operations. Based on our review of this section and figures 2-3b and 2-3c, DEQ also determines: 1) monitoring wells MW-4-57 and MW-17-79 are not appropriate to use as control wells as they are located to close to extraction wells, or are not constructed appropriately (i.e., MW-17-79 has a screen 40-feet long); and 2) there are no installations proposed to monitor the influence of the HC&C system in the lower portion of the upper Alluvium WBZ along the portion of Segment 1 where DNAPL occurs. As such, the monitoring well network should be modified to include:	Yes, all four bullet items will be discussed in the Construction Design Report, including the types of criteria that will be used for performance monitoring (i.e., particle tracking, vertical gradient analyses, flow maps). The numeric criteria will be developed in the Operations Design Report using data from testing the entire extraction system and are discussed in the Category 2 responses.

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	• Abandonment and replacement of monitoring well MW-17-79 with a control well constructed in the upper portion of the upper Alluvium WBZ and located approximately halfway between extraction wells PW-5U and PW-13U; • Installation of a control well in the upper Alluvium WBZ between extraction wells PW-5U and PW-14U; and • Construction of monitoring wells in the lower portion of the upper Alluvium WBZ at the PW-11U, PW-12U, PW-13U, and PW-14U extraction well locations.	Yes, these wells are planned to be added to the well network and will be addressed in the Construction Design Report.
	The additional monitoring wells should be equipped with transducers. The revisions and modifications listed above should be incorporated into the Draft Final Groundwater SCMs Design. DEQ's comments and expectations regarding the specific aspects of NW Natural's proposed groundwater monitoring program for extraction wells, monitoring wells, observation wells, and piezometers are attached (see DEQ's comments to Section 3.2.2.5.4 [Water Quality Trend Monitoring]).	Yes, these will be added in the Construction Design Report.
5	**DEQ General Comments, Page 10** **DNAPL Monitoring.** DEQ approves the portions of Section 3.2.2.5.3	

Category 1 **Agency Requests to be Addressed in Construction Design Report**	**NW Natural Response**
regarding "Monitoring and Recovery of DNAPL Entering Wells," "Monitoring of the Oil-Water Separators," and DNAPL Monitoring Reporting" subject to the specific comments attached. DEQ does not approve the portion of the section discussing "DNAPL Sampling" for the following reasons. • Consistent with requests made by DEQ in letters dated August 22, 2008 and March 26, 2010, and during meetings on February 3rd and March 3, 2011, NW Natural should revise geologic cross-sections to show locations near the shoreline where there is evidence of DNAPL occurrence (see DEQ's specific comment to Section 3.2.1.6, 4th paragraph); • Although the general rational for redesigning the portion of the Segment 1 HC&C system is provided in Section 3.2.2.2.1, operational parameters and performance criteria for achieving and maintaining HC&C of the Alluvium WBZ and assessing and minimizing potential DNAPL movement are not presented in the Revised Interim Design Report; and • The proposed Targost® sampling approach does not adequately assess lateral DNAPL migration, and does not propose to assess vertical DNAPL movement in the vicinity of extraction wells where the potential for movement in response to HC&C system operation is the greatest.	Yes, we will prepare these sections for the Construction Design Report. See response to Section 3.2.1.6 for more detail.

Attachment B
Gasco Source Control Design Report
Category 1 Responses to DEQ and EPA Comments

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To address each of these items, NW Natural should: • Fully respond to DEQ's comments made to the fourth paragraph of Section 3.2.1.6, by revising figures 2-3b and 2-3c, figures 2-5 through 2-8, and figures 3-8 and 3-9; • Develop HC&C operational parameters (e.g., placing upper limits on extraction well pumping rates) and performance criteria (e.g., ranges of horizontal and vertical hydraulic gradient values in the Alluvium WBZ within which DNAPL mobilization is minimized) to achieve hydraulic containment but not exceed conditions that could mobilize DNAPL; and • In addition to sampling areas 1, 2, and 3, NW Natural should use available information from groundwater modeling, and geologic cross-sections of the alluvium and DNAPL occurrence to determine where the potential for horizontal and/or vertical DNAPL migration is relatively high and target those areas for Targost® monitoring (e.g., below PW-6U; adjacent to and below PW-3-85; adjacent to PW-2L; adjacent to PW-14U). DEQ expects these revisions to the interim design to be included in the DNAPL monitoring section of the Draft Final Groundwater SCMs Design.	Yes, we will prepare these sections for the Construction Design Report, see response to previous request. These operational parameters and criteria will be developed in the Operations Design Report using data from testing the extraction well system. This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses. Yes, in the Construction Design Report we will evaluate where additional TarGOST borings are needed. Yes, the revisions will be in the DNAPL monitoring section of the Construction Design Report.

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6 **DEQ General Comments, Page 11** **Interceptor Trench Length, Alignment and Construction Sequence, Flow Rates, and Limitations on Uplands SCMs or Riverbank Alternatives** The Revised Interim Design Report is the first design document that presents an approach for controlling and containing groundwater in the Fill WBZ along shoreline segments 1 and 2. In general, DEQ accepts NW Natural's approach to controlling and containing groundwater in the Fill WBZ using a fully-penetrating interceptor trench. However, DEQ does not approve the interceptor trench design and has numerous comments regarding the recommended length, alignment, sequence and schedule for construction, estimated flow rates, and potential for the trench to interfere with other uplands SCMs. The Draft Final Groundwater SCMs Design document should include information to address each item. **Length.** The interceptor trench runs roughly parallel to the shoreline of segments 1 and 2, ending in the northern corner of NW Natural's property. However, the ACOE's remedial investigation found evidence of MGP contamination in soil and groundwater on the U.S. Moorings associated with the "former northern spent oxide/gas purifier waste storage pile" (spent oxide pile). Work	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
completed by NW Natural documents soil and groundwater contamination associated with the spent oxide pile in the uplands and offshore of the northern portion of the NW Natural Property. The spent oxide pile was formerly located immediately adjacent to, and along the property line between the NW Natural and ACOE properties.	
As indicated in DEQ's March 10, 2010 letter commenting on the RI Report and Risk Assessment, NW Natural should conduct additional soil and groundwater investigations in the northern portion of the NW Natural Property to: 1) delineate the nature and extent of MGP contamination in soil and groundwater; 2) evaluate the occurrence and direction(s) of groundwater flow in the Fill WBZ and Alluvium WBZ; and 3) characterize the concentrations of MGP COI in soil and groundwater migrating from the NW Natural to offsite areas, including the U.S. Moorings site.	These requests regarding planning and implementation of an investigation related to the U.S. Moorings property will be addressed in the Construction Design Report. However, this work will be conducted as a discrete project so that it will not delay completion of design and implementation of the Alluvial WBZ extraction system. More detail on this issue is provided in the Category 3 responses, item 2.
The scope of work for these investigations should include drilling and installation of monitoring wells in the Fill WBZ and Alluvium WBZ. Based on the data collected by the ACOE and NW Natural, the results of this work could indicate contaminated groundwater is migrating offsite to the north and discharging to the river via the U.S. Moorings site. As such, groundwater sampling in the northern	

Category 1 Agency	Requests to be Addressed in Construction Design Report	NW Natural Response
	portion of the NW Natural's property could influence the groundwater SCMs design along shoreline Segment 2 (e.g., result in lengthening the interceptor trench; the addition of extraction wells in the Alluvium WBZ). NW Natural should fully discuss the scenario involving the U.S. Mooring site in the context of the groundwater SCMs design for the fill and Alluvium WBZ and the sequence and timeframe for conducting the additional soil and groundwater investigations. In addition to the U.S. Mooring site, groundwater data for the Fill WBZ collected at the WS-8 well cluster indicates the length of the interceptor trench should be extended to near the southern end of Segment 1. Extension of the trench should be further evaluated and discussed in the Draft Final Groundwater SCMs Design.	Yes, the plan is to extend the interceptor trench, as requested by DEQ. The details will be provided in the Construction Design Report.
7	**DEQ General Comments, Pages 11 and 12** **Alignment and Sequence.** The Revised Interim Design Report recommends constructing the Fill WBZ interceptor trench concurrently with the riverbank cleanup included in the in-water sediment remedy. DEQ understands the primary justification for the recommendation is the presence of shoreline structures, including the FAMM tank farm, FAMM office, Siltronic's outfall, and docking and mooring structures. NW Natural indicates that in these areas, "…the trench will be constructed at the top of the	DEQ's request to redesign the Fill WBZ interceptor trench and move it to the other side of the extraction wells is addressed in the response letter, to which this is attached.

Category 1 **Agency Requests to be Addressed in Construction Design Report**	**NW Natural Response**
riverbank or partially on the riverbank slope due to the presence of the shoreline structures." Although DEQ acknowledges shoreline structures and facilities present difficulties with regard to access and construction, we disagree with NW Natural's recommended alignment and construction sequence for the following reasons: • Postponing constructing the trench until sometime after the in-water project is initiated will significantly delay source control of the Fill WBZ. Constructing the trench before the riverbank project is initiated will achieve source control in the Fill WBZ years earlier for most of shoreline segments 1 and 2. • Shoreline interferences are primarily associated with the FAMM leasehold. The FAMM leasehold represents approximately 600-feet of about 2,000-feet of shoreline. Upstream and downstream of the leasehold there appears to be working room. As such, it appears approximately 1,400-feet of trench does not have significant access and/or construction restrictions. Furthermore, the accessible 1,400-feet of trench alignment roughly coincide with the most significant contamination in the Fill WBZ near the shoreline. • Setting the trench back from the top-of-bank will reduce uncertainty regarding slope stability and intercept	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
contaminated groundwater further upgradient of the river. Locating the trench on the uplands side of the extraction wells would also allow for performance/effectiveness monitoring using existing and proposed Fill WBZ monitoring wells. • Where mobile DNAPL occurs along the alignment, construction of the trench will promote DNAPL movement into the trench. Placing the trench near or on the riverbank could induce DNAPL movement towards the riverbank following NW Natural's recommendation. Aligning the trench near the extraction wells will induce DNAPL movement away from the riverbank and remove DNAPL from the fill in areas where downward vertical gradients between the Fill WBZ and Alluvium WBZ are greatest (i.e., above extraction wells). Except for the section along the FAMM leasehold, NW Natural should reevaluate the alignment, sequence, and schedule to construct most of the trench in the same timeframe and along a similar alignment as the HC&C system.	
8 **DEQ General Comments, Page 12** **Flow Rates.** NW Natural indicates the Alluvium WBZ HC&C system is a higher priority for implementation than the interceptor trench based largely on NW Natural's expectation that flow rates	

Category 1 Agency Requests to be Addressed in Construction Design Report		NW Natural Response
	from the Fill WBZ will be less than 10% of the Alluvium WBZ (i.e., the Alluvium WBZ HC&C system will intercept more than 90% of the contaminated groundwater migrating to the river). Information available in the RI Report suggests NW Natural's estimate may be low. The RI Report indicates that during 2005, on an average daily basis 20,000 gallons of storm water and contaminated groundwater from the Fill WBZ were pumped out of the LNG tank basin, treated using granulated activated carbon, and discharged to the City of Portland publically-owned treatment works (POTW). The average daily removal rate corresponds to approximately 15 gpm. DEQ acknowledges the removal rate includes storm water, but notes the bottom of the LNG Basin is typically 2 to 7 feet below the water table in the Fill WBZ. Furthermore, the LNG Tank basin intercepts only a portion of the total groundwater moving through the Fill WBZ towards the river. Based on the information above and the magnitude of contamination in the surficial fill near the river, NW Natural should fully document estimates of groundwater flux through the Fill WBZ, including the magnitude and timing of seasonal extremes for purposes of verifying the anticipated total flow rate of 20 gpm.	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.
9	**DEQ General Comments, Pages 12 and 13**	

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	Potential Limitations on Uplands SCMs and/or Riverbank Alternatives. As DEQ indicated in the March 21, 2008 letter regarding the Groundwater/DNAPL FFS, planning, design, and implementation of the uplands SCMs must take into consideration future riverbank work, including but not limited to bank repair, stabilization, and/or excavation, removal, and replacement. DEQ continues to maintain construction of the riverbank remedy should not interfere with the uplands SCMs, which now includes the Fill WBZ interceptor trench, the Alluvium WBZ HC&C system, and the treatment system and its associated equipment, buildings, and piping. Likewise, uplands SCMs should not limit NW Natural's ability to implement effective remedial alternatives to address the riverbank. Implementation of groundwater SCMs should satisfy two conditions: 1) the interceptor trench and HC&C system should preserve maximum flexibility in accommodating the range of options for remediating bank soil and river sediment, and 2) future riverbank work should not interfere with construction of groundwater SCMs or compromise groundwater SCMs during riverbank sediment remedy construction.	Yes, in principal these conditions make sense. However, the phrasing and meaning of the conditions needs further evaluation and discussion. Please see item 3 in the Category 3 responses for further details.
10	**DEQ General Comments, Page 13** **Treatment System Building Locations and Treated Water Discharge**	

Category 1 Agency Requests to be Addressed in Construction Design Report		NW Natural Response
	Locations. The treatment system and pre-treatment system buildings are located within former Gasco Facility lampblack and/or effluent ponds waste management areas. The soils underlying these former MGP waste management areas exceed human health and ecological risk-based criteria. Furthermore, NW Natural and DEQ agree that the former effluent ponds waste management area (i.e., the Tar Ponds area) represents a hot spot of contamination for soil and groundwater. Contamination underlying the treatment and pre-treatment building locations is not discussed in the Revised Interim Design Report. The Draft Final Groundwater SCMs Design should provide a development plan that addresses contamination during treatment building and pre-treatment building site preparation and construction. The building locations should also be discussed in terms of uplands final remedial action alternatives (e.g., potential to interfere with, or an element of remedial alternatives. Alternatively, NW Natural could consider relocating the buildings to an area(s) where the magnitude of soil contamination is less significant, the need for site preparations is reduced, and the potential to interfere with final remedial actions is less.	Yes, this issue will be evaluated and a revised design will be provided in the Construction Design Report.
11	**DEQ General Comments, Page 13**	

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	Treated Water Discharge. The approach for discharging treated water to the Willamette River is an important component for the SCMs design and NPDES permit application. The Revised Interim Design Report does not provide information on NW Natural's approach. Based on an e-mail sent by NW Natural on August 29, 2011, DEQ understands the approach will involve discharging treated water to the river via piping which will require additional information to supplement the SCMs design and NPDES permit application. NW Natural should be advised additional state and/or federal permits could be required for the outfall.	This issue will be addressed in the Construction Design Report.
12	**DEQ Specific Comments, Pages 1 and 2** **Introduction.** As indicated in our General Comments, DEQ does not consider the Revised Interim Design Report to be a 100% submittal ready for construction. **Section 1.1.** Appendix B is incomplete and should include copies of DEQ's letters dated August 9, 2010 and October 27, 2010. In addition, the appendix should include an e-mail from Bob Wyatt to Jim Anderson dated January 3, 2011 indicating final agreement on dispute resolution conditions arising out of NW Natural's acceptance of DEQ's proposal. **Section 1.2.** DEQ's General Comment on the groundwater SCMs	Yes, we will include these items in the Construction Design Report.

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RAOs apply here. **Section 1.3.** According to NW Natural, "…construction of the extraction wells would not restrict future riverbank cleanup options." DEQ will require the extraction wells to be constructed in such way so as not to restrict uplands remedial action alternatives, including but not limited to soil and MGP waste excavation and removal. The timing and construction f the Fill WBZ trench is discussed in General Comments. **Section 2.1.1.** DEQ's comments to Section 3.2.1.1 apply here. **Section 2.1.2.** In addition to materials listed in the first sentence of the section and depending on location, the Fill WBZ is made up of varying proportions of MGP waste, including spent oxide material, lampblack, carbon pitch, tar, and/or oil. For example, in the northern portion of the NW Natural Property, the Fill WBZ material includes spent oxide material. **Section 2.1.3.** To date documentation of the changes made to MODFLOW model due to testing pilot extraction wells PW-7-93, PW-8-39, PW-8-68, and PW-9-92 has not been provided to DEQ. In addition, DEQ's general comments regarding long-term operation of	

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
the HC&C system apply here. **Section 2.1.3.1.** NW Natural's discussion of the deeper Alluvium WBZ aquitard (deeper aquitard) is presented in this section. As indicated in the Interim Design Report, NW Natural relied on observations made during drilling of shoreline monitoring wells and Targost® logs to develop interpretations of the depth, thickness, and lateral extent alluvial sediments, including the deeper aquitard. DEQ understands interpretations involving Targost® borings were actually based on data generated by the cone-penetrometer tool (CPT). DEQ further understands that prior to use on the NW Natural property, the Targost® probe and CPT were advanced adjacent to previously drilled and visually logged borings for comparison and correlation purposes. Consistent with the March 29th letter and for clarification, DEQ is requesting NW Natural to document the work done to correlate the CPT logging data to drilling observations, and describe how this information was used to interpret the stratigraphy at each of the Targost® borings. NW Natural should provide copies of CPT logs, comparisons of subsurface observations with corresponding CPT logs; and correlation criteria for assigning material types to the CPT logs. DEQ is particularly interested in the criteria used to interpret	Appendix D in the Draft Final Source Control Design Report was intended to respond to DEQ's previous request for this information. NW Natural would like to discuss what additional information is needed before doing additional work to answer this request. After the discussion, if further information is needed, it will be provided in the Construction Design Report.

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	the presence of the deeper aquitard. This information should be provided in the Draft Final Groundwater SCMs Design for DEQ's information and for completeness.	
13	**DEQ Specific Comments, Pages 2 and 3** **Section 2.1.4, 2nd paragraph.** Regarding offshore investigations, NW Natural indicates, "DNAPL was not detected in any of the borings below an elevation of approximately 17 feet COP." The referenced elevation should be revised to "-17 feet COP." In addition, evidence of DNAPL was found at Boring GS-09 at an elevation of approximately -25 feet COP. For example, see Figure 3 or figures 5-F1 through 5-F5 of the Groundwater/DNAPL FFS. The combination of figures 2-12a through 2-12c and figures 2-13a and 2-13b provide good illustrations of groundwater contamination migrating offshore and under the river. That said the subsurface distributions of free and total cyanide shown by figures 2-13a and 2-13b rely on interpretations of data collected from nearshore borings GS-01 through GS-12. These borings are located between 75 and 125 feet downgradient and under the river from where monitoring wells and extraction wells are located. In addition, the groundwater data shown represent one-time reconnaissance samples collected during	This revision will be addressed in the Construction Design Report.

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
drilling in the fall of 2007. As indicated in our March 26, 2010 letter regarding the Interim Design Report, figures should be prepared that are representative of uplands groundwater data where source control will occur. Figures for free cyanide and total cyanide should be prepared along a cross-section corresponding to figures 2-3a through 2-3c (i.e., the cross-section containing uplands control, monitoring, and extraction wells). Similar figures were previously prepared by NW Natural for the Groundwater/NAPL Pilot Program Report[2] (see figures 5c and 5e). In addition, it is unclear why figures 2-13a and 2-12b only show data for free and total cyanide. DEQ understands total cyanide is a widely distributed MGP chemical of interest (COI). However, as NW Natural indicates in Section 3.2.1.1 that benzene, toluene, and naphthalene are also widely distributed and generally representative of MGP COI. Groundwater in the uplands along the shoreline is also impacted by chlorinated volatile organic compounds (cVOCs) due to releases caused by Siltronic. For completeness, figures should be prepared for additional COI, including benzene, naphthalene, toluene, cis-1,2-dichloroethene, and vinyl chloride along a cross-section containing uplands control, monitoring, and extraction wells.	Figure 2-11 in the Draft Final Source Control Design Report displayed these data, with the exception of the toluene and Cis 1,2 DCE data. To respond to this request, it is proposed that that those two analytes be added to that figure and the cross section length extended to the north property line of NW Natural. Yes, as discussed in the previous response, it is proposed to modify Figure 2-11 to respond to this request.

[2] Anchor QEA, LLC, 2007, "Groundwater/NAPL Pilot Program Extraction Well and Performance Evaluation Design Report," May, a report prepared for NW Natural.

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As done previously, NW Natural should use reconnaissance groundwater data as needed to fill data gaps. **Section 3.1.1.** DEQ's general comment regarding RAOs applies here. **Section 3.1.1.1, last paragraph.** In addition to pointing out free cyanide was not detected in surface water samples, the paragraph should indicate total cyanide was detected in three samples at concentrations ranging from 10 micrograms per liter (ug/L, or parts per billion) to 140 ug/L. **Section 3.1.2.** For clarification, although the National Pollutant Discharge Elimination System (NPDES) permit application was submitted to DEQ in February 2011, the application was not complete until the Land-Use Compatibility Statement was received by DEQ in May 2011. In addition, during review of the NPDES permit application and Revised Interim Design Report; DEQ requested information via e-mails sent April 14, 2011 and August 17, 2011 on NW Natural's proposed approach for conveying treated water to the river. As indicated in DEQ's general comments, the approach for discharging treated water to the river is an important component for the SCMs design and NPDES permit application.	Yes, this text will be revised in the Construction Design Report.

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	NW Natural replied to DEQ's e-mails on August 29th. DEQ understands NW Natural intends to pipe treated water to the river and request a mixing zone for the discharge, both of which will require additional information to supplement the NPDES permit application and may involve additional state and federal permits. The Draft Final Groundwater SCMs Design should include NW Natural's proposed outfall design.	Yes, the outfall design will be included in the Construction Design Report.
14	**DEQ Specific Comments, Pages 3 and 4** **Section 3.1.3.** This section of the Revised Interim Design Report indicates that when an extraction well is shut-down for maintenance the flow rates of adjacent extraction wells will be increased to maintain hydraulic capture. NW Natural should discuss this situation in the context DEQ's general comments on the long-term operation/effectiveness of the HC&C system and DNAPL movement. DEQ is concerned increasing flow rates during extraction well maintenance and/or replacement could cause excessive drawdown in the upper Alluvium WBZ extraction wells and increase DNAPL mobilization in the portion of Segment 1 where DNAPL occurs. Under this scenario and depending on the shut-down time, maintaining extraction well discharges to sustain operation and minimize potential DNAPL movement may be preferred.	Yes, we will address this issue in the Construction Design Report. The Construction Design Report will also identify contingencies that could be implemented if testing of the system shows that this could be a problem. The water level data obtained from testing the completed system will be used to determine if this is a problem, and if so, mitigation alternatives will be provided in the Operations Design Report.

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Section 3.1.3, last paragraph page 14. NW Natural indicates backup generators will be available in the event of a PGE power failure. Given the potential for flooding at the site and the extenuating circumstances associated with flooding, including system shut-down, NW Natural should clarify whether backup generators are intended to keep the HC&C operating under these conditions. DEQ acknowledges NW Natural's plans for responding to HC&C system shut-downs caused by equipment (e.g., pumps available onsite; backup generators) and agrees an assessment of water quality changes under selected shut-down scenarios is no longer warranted. **Section 3.2.1.1, 1st paragraph.** NW Natural indicates DEQ required a series of investigations to be conducted in the Willamette to, "…determine the nature and extent of contamination in offshore groundwater and river sediments." For clarification, although DEQ did oversee the in-water work referenced by NW Natural and documented in the Offshore Investigation Report[3], DEQ was primarily interested in investigations designed to assess potential ongoing uplands contaminant transport pathways (e.g., direct discharge, groundwater) as sources of contamination to the river and river sediments. This data was incorporated into the	Yes, the Construction Design Report will clarify that the generators are intended to operate under these conditions.

[3] Anchor QEA, LLC, 2008, "Offshore Investigation Report - NW Natural 'Gasco' Site," February, a report prepared for NW Natural.

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Groundwater/DNAPL FFS and the SCMs planning and design process. However, the objective of a significant amount of the work performed during the offshore investigation was supporting the Portland Harbor in-water RI/FS being performed by the Lower Willamette Group under EPA's oversight. Furthermore, off-shore investigatory work supplied surface water, sediment, transition zone water, and shallow groundwater data to assist planning of the in-water sediment project also being overseen by EPA. **Section 3.2.1.1, 6th paragraph.** In general DEQ concurs with NW Natural regarding free cyanide bioavailability and toxicity. Although not mentioned in the Revised Interim Design Report, in previous correspondence and meetings DEQ has informed NW Natural that free cyanide data alone is not adequate for assessing potential impacts to the river. As part of planning and designing the treatment system for the groundwater SCMs and during groundwater monitoring, NW Natural evaluated concentrations of "available" and "weak-acid dissociable" (WAD) cyanide. Cyanide in these forms has the potential to convert to free cyanide in the river environment and is being considered in evaluations of the groundwater pathway and treatment system design. In a memorandum dated August 20, 2010 and for purposes of	

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groundwater monitoring, NW Natural recommends using the only WAD method to assess forms of cyanide with the potential to convert to free cyanide in the river. DEQ does not approve the recommendation based on the information presented. The WAD and available cyanide methods should provide similar results. However, based on the data compiled in the August 20th memorandum, the WAD method consistently reports much higher concentrations of WAD cyanide compared to the available cyanide method. If the WAD cyanide results are used to assess the potential concentrations of cyanide which could convert to free cyanide, then the conclusion which flows from the data is the flux of free cyanide being discharged to the river via groundwater is potentially significant. DEQ considers the difference the two methods to be significant enough to conclude the WAD cyanide values are overly conservative for purposes of the project. DEQ requests the groundwater monitoring program retain analysis of cyanide using the total, available, and free methods. Using the available method also has the advantage that groundwater monitoring data can be compared directly to treatment system influent and effluent data. Also, DEQ understands NW Natural continues to rely on a single laboratory for available cyanide analyses. If this is the case and NW	Yes, the Construction Design Report will be revised to require testing for these three cyanide analytes. NW Natural is currently in the process of selecting a local testing laboratory to do the available cyanide test. The Construction Design Report will incorporate a plan for the use of split samples for the purpose of evaluating

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	Natural has not already done so, then DEQ requests laboratory splits be run on selected samples to evaluate the performance of the laboratory NW Natural is using. Split sampling should be coordinated with DEQ.	lab performance.
15	**DEQ Specific Comments, Pages 4 and 5** **Section 3.2.1.4.** DEQ has numerous comments regarding this section of the Revised Interim Design Report which are provided below. • DEQ believes the first full paragraph at the top of page 20 is incorrect, inconsistent with the information provided in Appendix F, and does not reflect DEQ's understanding of, or involvement in the modeling process. DEQ is willing to discuss development of the MODFLOW further, but this paragraph should be deleted from the Draft Final Groundwater SCMs Design. • For clarification, DEQ considered simulations using March 27, 2000 data to be representative of a reasonable worst-case scenario where groundwater extraction rates and treatment system flow rates are concerned. The simulations were used in the source control planning and design process to further evaluate the potential maximum extraction rate and treatment flow rate of the HC&C system and treatment system respectively. The simulations completed for this purpose	Based on DEQ comments in the March 26, 2010 letter, NW Natural understands that the MODFLOW model was approved for source control design purposes. However, the DEQ's September 22, 2011 comments regarding this issue are inconsistent with that approval.

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should not be represented as the reasonable worst-case scenario for all situations related to the performance of the HC&C system. For example, to assess seasonal maximum drawdowns in the upper Alluvium WBZ extraction wells would require using a different set of assumptions.	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.
• Documentation of the changes made to the model mentioned at the top of page 21 should be provided, including the reason for extending the model to include U.S. Moorings; the affect the modifications had on modeling results, and a figure showing the hydraulic conductivity values assigned to the upper Alluvium WBZ.	Yes, this information will be provided in the Construction Design Report.
• Further explanation of the nested table of groundwater inflow rates on page 20 is needed. In particular NW Natural should clarify the relationship between the values shown in the table to the extraction rates of wells pumping from the upper Alluvium WBZ and lower Alluvium WBZ; and the flow rates into the interceptor trench and the treatment system. For example, total groundwater inflow to the "Upper Alluvium" and "Lower Alluvium above the Aquitard" is estimated to be 955 gallons per minute. However, the total modeled extraction rate for the Alluvium WBZ HC&C system is 260 gallons per minute (gpm) and the range of treatment design flow rates ranges between 663 and 805 gpm.	Yes, this information will be provided in the Construction Design Report.

Attachment B
Gasco Source Control Design Report
Category 1 Responses to DEQ and EPA Comments

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• DEQ understands Figure 3-2 is based on the March 27, 2000 water level data. NW Natural should indicate the extraction rates for each well or group of wells shown (e.g., upper Alluvium WBZ and lower Alluvium WBZ). NW Natural should also indicate whether operating the HC&C system under these conditions results in capture zones representative of the covering the minimum, average, or maximum lateral extent. • Figure 3-2 depicts an Alluvium WBZ HC&C system capture zone in plan-view. According to Section 3.2.2.2.1 (7th paragraph) the figure shows groundwater being prevented from migrating to the river. DEQ considers a single plan-view figure to be inadequate to illustrate HC&C of the Alluvium WBZ over the depth intervals of interest. DEQ requests that additional plan-view figures be developed for the Draft Final Groundwater SCMs Design to show capture zones at elevations corresponding approximately to the "upper" extraction well screens, the lower portion of the upper Alluvium WBZ, the "lower" extraction well screens; near the top of the deep aquitard; and at the base of the alluvial sequence. In addition, three cross-sectional views of capture zones should be provided through extraction well locations PW-2, PW-6, and PW-9. The corresponding times after HC&C system start-up	Yes, the extraction rate information used for design modeling can be provided in the Construction Design Report. However, the prediction of the lateral extent of capture zones will be more reliably developed in the Operations Design Report using data obtained from testing the entire extraction system. Doing this type of predictive modeling will not be useful until all of the extraction wells are installed and tested and the MODFLOW model updated with revised site parameters and calibrated to system-wide test data. Our preference is, therefore, to conduct this modeling effort after that entire extraction system test. Yes, these additional plan view figures and cross sectional views can be prepared for the Construction Design Report using the existing MODFLOW model.

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the capture zone represent should be indicated on all of the figures. • DEQ understands NW Natural used 10 feet/day as an estimate for the hydraulic conductivity of the Fill WBZ to provide conservative estimates for purposes of planning and designing the interceptor trench. DEQ further understands, NW Natural's estimate of the total groundwater flow intercepted by the trench (20 gpm) is based on modeling and represents a reasonable maximum value under seasonal site-specific conditions. NW Natural should verify these understandings and confirm the 20 gpm estimate in response to DEQ's general comment on trench flow rates.	Yes, this will be done in the Construction Design Report.
The results of ongoing transient MODFLOW simulations of the HC&C system should be included in the Draft Final Groundwater SCMs Design. DEQ's general comment on evaluating the long-term operations/effectiveness of the HC&C system also applies here.	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.
16 **DEQ Specific Comments, Pages 5 and 6** **Section 3.2.1.5.** DEQ understands figures 3-3a and 3-3b depict groundwater gradient components at steady state, while pumping the HC&C system at 260 gpm under the March 2000 water level	

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conditions. NW Natural should identify the cross section locations and indicate what the figures represent (e.g., gradients resulting from HC&C operations during seasonal high groundwater levels).	Yes, this will be done in the Construction Design Report.
Section 3.2.1.6, 2nd paragraph. According to NW Natural, the Targost® technology, "…is reliable for the detection of the presence of tar and oil, but cannot differentiate between tar and oil or determine if the material is mobile." DEQ continues to disagree with NW Natural's description of the technology where the alluvium is concerned. Setting the question of differentiating tar and oil aside, based on the material properties of MGP waste and the subsurface geology, DEQ considers the Targost® technology to be a reliable method for identifying mobile DNAPL in the upper alluvium (i.e., below the top of the upper silt unit). Identification of MGP waste below the top of the upper silt unit in the alluvium indicates mobile DNAPL occurs at those depth intervals. That said, DEQ acknowledges Targost® equipment cannot determine whether DNAPL in the alluvium has reached a stable subsurface configuration (i.e., stopped moving) based on a single logging event.	
Section 3.2.1.6, 3rd paragraph. DEQ notes that based on Targost® work, interpretations regarding the lateral extent of DNAPL in the	These drawings will be reviewed to assess this issue and revised as needed in the Construction Design

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Alluvium WBZ shallower than 100 feet below ground surface (bgs) increased from approximately 4 acres to over 10 acres. **Section 3.2.1.6, 4th paragraph.** The figures referenced in this section of the interim design report appear to rely on: 1) geologic observations made during the most recently completed geotechnical drilling and monitoring well installation work; and 2) DNAPL intervals identified during Targost® logging work. NW Natural indicates the use of previously prescribed methods (e.g., visual observations during drilling, field UV screening, Targost® logs) provide the basis for determining DNAPL occurrence at a boring location. NW Natural further indicates, "The combined methods for DNAPL detection are considered consistent and accurate." In addition to the methods mentioned by NW Natural, DEQ considers observations of sheen as providing evidence of the presence of DNAPL. This conclusion is based on observations made at a number of monitoring wells (e.g., WS-11, WS-14) where sheen observed during drilling preceded DNAPL entering the installation. Based on this information, Figures 2-3b and 2-3c, figures 2-5 through 2-8, and figures 3-8 and 3-9 should be revised to show depths intervals where evidence of DNAPL was observed during any uplands drilling work completed in the areas shown in cross-section,	Report.

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including but not limited to borings B-29, B-55, B-57, B-58, B-59; boreholes at the MW-18, MW-19, WS-11, WS-14, and WS-16 monitoring well clusters; and PW-01-80. These locations are referenced here as visual evidence of DNAPL (e.g., sheen) was observed during drilling and/or DNAPL entered the installation after construction. Drilling observations made during installation of monitoring wells and extractions wells for the Segment 2 pilot extraction tests should be included in the review. For purposes of groundwater source control planning and design, compiling information regarding DNAPL occurrence on geologic cross-sections is intended to support HC&C system design and development of the performance monitoring program, not better understand DNAPL distribution as NW Natural suggests. As such, the consistency and accuracy of the methods used to interpret DNAPL occurrence is less important than assessing the potential distribution of DNAPL relative to extraction wells and performance monitoring wells. The figures should be reviewed, revised, and resubmitted for the Draft Final Groundwater SCMs Design. Alternatively, a set of cross-sections modified per DEQ's comment could be prepared for this purpose and attached as an appendix. DEQ previously requested the figures be updated as discussed	For NW Natural's response to this request please refer to the Category 3 responses, item 4. The requested cross sections will be appended to the Construction Design Report.

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above in letters dated August 22, 2008 and March 26, 2010, and during meetings on February 3rd and March 3, 2011. As indicated in the General Comments, DEQ considers this a key issue for a developing the performance monitoring plan for DNAPL.	
17 **DEQ Specific Comments, Pages 6 and 7** **Section 3.2.1.7.** NW Natural indicates DNAPL migration estimates are conservative approximations as they do not include capillary forces which would tend to resist movement. As DEQ has indicated in previous comments letters, capillary forces do not influence DNAPL migration to the extent NW Natural implies. Laboratory testing found DNAPL near the shoreline to be of intermediate or neutral wettability (i.e., affect of capillary forces is reduced or limited). DEQ believes observations and measurements of DNAPL occurrence under the former Tar Ponds Area provide a sound technical basis for estimating transport rates, and indicate actual mobility is greater than predictions based on groundwater numerical simulations. This information is an important consideration for monitoring HC&C performance, especially near extraction wells where DNAPL occurrence and hydraulic gradients due to pumping are greatest. The Draft Final Groundwater SCMs Design should acknowledge the results of DNAPL wettability testing near the river.	NW Natural agrees that wettability is a factor that affects the mobility of DNAPL. However, we request a meeting to receive clarification from DEQ on how these issues should be used to design the performance monitoring program. As a clarification, we did not use numerical modeling to predict DNAPL mobility. We used only the change in gradient from the model as an input to our separate evaluation of DNAPL mobility.

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Section 3.2.1.8. For clarification, DEQ approved NW Natural's proposal to implement DNAPL removal from the former effluent ponds area(s) after construction of the HC&C system (and vertical barrier) in a letter dated June 9, 2009. DEQ's March 26, 2010 comments on the Interim Design Report acknowledged that DNAPL removal and the vertical barrier NW Natural recommended along a portion of shoreline Segment 1 (i.e., where DNAPL occurs) could be evaluated in the uplands FS. The June 2009 and March 2010 letters should be referred to for additional information.	NW Natural is unclear what information DEQ believes should be referred to in their June 2009 and March 2010 letters. We respectfully request that DEQ identify that information so that NW Natural is clear on how DEQ expects those letters to affect source control design.
Section 3.2.1.9. According to NW Natural, pumping lower Alluvium WBZ extraction wells PW-7, PW-8, and PW-9, "…has little or no short-term measurable water level effect on nearby wells screened in the overlying Fill WBZ." This information supports DEQ's position laid-out in our general comments that the Fill WBZ interceptor trench should be constructed within the same timeframe as the HC&C system because shallow contaminated groundwater will continue to discharge to the river otherwise.	
NW Natural indicates the aquifer properties determined from the Segment 2 pilot extraction well tests have been incorporated in the MODFLOW model for the site. Since the October 2008 revisions, DEQ has not received updated information documenting changes	

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made to the model. As indicated in our March 26, 2010 letter commenting on the Interim Design Report, DEQ expects NW Natural to provide updated documentation regarding the MODFLOW model, including but not limited to: • Updates and refinements made for the revised interim design, basis for the change(s), and affect on simulations; • Updated figures showing the current model boundaries and grid spacing; • Dimension, geometry, and thickness of the deeper aquitard in the model; and • Hydraulic properties assigned to the model layers including, but not limited to calibrated horizontal and vertical hydraulic conductivity values, and specific yield and storativity values of the Fill WBZ and Alluvium WBZ respectively.	Yes, this information will be provided in the Construction Design Report.
DEQ also requests information on how the model handles water levels in the Alluvium WBZ which are drawn down below the bottom of the upper silt unit (i.e., under these conditions does the model assign a specific yield value to the upper Alluvium WBZ).	Yes, if the model predicts drawdown below the bottom of the upper silt unit, transmissivity is calculated based on the saturated thickness and the unconfined storage coefficient is used.
Documentation of the most current version of the MODFLOW model being used to simulate hydrogeologic conditions and the Fill WBZ and Alluvium WBZ SCMs should be provided as an appendix	Yes, this information will be provided in the Construction Design Report.

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	in the Draft Final Groundwater SCMs Design. In addition, DEQ requests that NW Natural provide a working version of the model for our information and use.	
18	**DEQ Specific Comments, Pages 7 and 8** **Section 3.2.2.** DEQ's general comments regarding the interceptor trench apply here. **Section 3.2.2.1.** DEQ's general comments regarding the interceptor trench apply here. **Section 3.2.2.2.1, 2nd full paragraph page 28.** DEQ acknowledges and accepts NW Natural's rational for adding the upper Alluvium WBZ extraction wells to the HC&C system. For clarification regarding Item #4, increasing the number extraction wells in the upper Alluvium WBZ reduces the pumping rates and lateral gradients between installations; however the lateral gradients will be greater than under ambient non-pumping conditions. **Section 3.2.2.2.1, 1st paragraph page 29.** NW Natural indicates two factors were used to select the elevation of extraction well screens, including: 1) setting the screened intervals shallow enough to control vertical gradients and reduce the potential for DNAPL mobilization; and 2) placing the wells deep enough to provide	DEQ's request to redesign the Fill WBZ interceptor trench and move it to the other side of the extraction wells is addressed in the response letter to which this is attached. Yes, this analysis was done using historic groundwater elevation data for the site and the specific capacity information from pump testing of the wells. For the

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sufficient available drawdown for the anticipated range of pumping rates needed for gradient control. To date, DEQ is not aware of NW Natural having actually compared the available drawdowns to the drawdowns predicted based on simulations of the long-term full-scale operation of the HC&C system. As indicated in DEQ's general comments on the long-term operation and effectiveness of the HC&C system, the Draft Final Groundwater SCMs Design should include such an evaluation under seasonal extremes of groundwater levels and river stage and NW Natural's recommended pump placements shown in Figure 3-7b. The comparison should also consider specific capacity estimates NW Natural derived from the extraction well tests previously conducted at the site. **Section 3.2.2.2.1, 2nd paragraph page 29.** NW Natural's response to DEQ's comments on placing extraction in the zones of highest groundwater contamination is acceptable. **Section 3.2.2.2.1, 3rd paragraph page 29.** NW Natural indicates that, "Based on review of Figure 2-11 and the Segment 3 source control evaluation report, NW Natural does not see a technical basis for extending Segment 1 further on the Siltronic property. With regard to the Alluvium WBZ and adding an extraction well upstream of PW-1, DEQ concurs with NW Natural's conclusion given the	Upper Alluvium wells, the bottom of the intake screen was set no lower than the known depth of nearby DNAPL to facilitate the control of vertical gradients. This will be further explained in the Construction Design Report. Predictions conducted now for full scale operation of the completed system would necessarily be of limited use because the performance of future wells cannot be predicted with a sufficient degree of accuracy. To be of practical value, future analysis of this issue should be done using water level data from testing of the completed system and the results reported in the Operations Design Report.

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	information provided in the Revised Interim Design Report. For the Fill WBZ, groundwater data shown on Figure 2-11c (e.g., cyanide) indicates the length of the interceptor trench shown by Figure 2-2c should be extended beyond WS-8 (i.e., to near the southeastern end of Segment 1). Extension of the trench should be further evaluated and discussed in the Draft Final Groundwater SCMs Design.	Extension of the Fill WBZ interceptor trench as requested by DEQ is acceptable, and the revision will be in the Construction Design Report.
19	**DEQ Specific Comments, Page 8** **Section 3.2.2.2.1, 1st paragraph page 30.** DEQ's comment to Section 3.1.4 regarding capture zone figures applies here. DEQ understands Figure 3-2 depicts the steady-state capture zone for the Alluvium WBZ HC&C system proposed in the Revised Interim Design Report, pumping at a total discharge rate of 260 gpm, under the March 27, 2000 water level(s) scenario. DEQ further understands that except for the changes listed in Section 3.2.1.4 (top of page 21) and the addition of the deep aquitard for the Interim Design Report, the current version of the MODFLOW model is carried forward from October 2008. NW Natural should confirm these are the only changes made to the model or provide additional clarifying information.	Yes, these questions will be answered in the Construction Design Report.

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Section 3.2.2.2.1, 2nd paragraph page 30. DEQ requests NW Natural to evaluate adding upper Alluvium WBZ extraction wells at the PW-09 and PW-10 locations (i.e., PW-10U). DEQ believes these extraction wells may be warranted as: 1) the highest concentrations of free cyanide and total cyanide in the upper Alluvium WBZ are detected in the vicinity of the PW-09 and PW-10 locations; and 2) the response to pumping pilot extraction wells suggest the hydraulic influence of deep extraction wells on the upper Alluvium WBZ in this portion of the site may be less than previously thought.	Yes, this request will be addressed in the Construction Design Report. NW Natural agrees that it is important to capture groundwater in the Upper Alluvium in this area and it is our full intent to do so. However, it is NW Natural's proposal to install the system as it is currently designed and test the complete system. That data would then be used to do a capture analysis in the Operations Design Report to determine if extraction wells in the Upper Alluvium are needed in this area.
Section 3.2.2.2.1, last paragraph. DEQ acknowledges NW Natural's commitment to adjusting the screened intervals of extraction wells to avoid penetrating fine-grained layers. However, figures 2-3c and 2-11b show the screened interval of extraction wells PW-1L and PW-2L crossing a relatively thick laterally extensive fine-grained layer. NW Natural should revise the figures for the Draft Final Groundwater SCMs Design to show the intended vertical placement of these wells in the context of the geology shown in the figures.	Yes, we will do this in the Construction Design Report.
Section 3.2.2.2.2, 1st paragraph. DEQ notes NW Natural recommends constructing extraction wells using six-inch diameter steel casing and wire-wrapped screen. Extraction wells PW-3, PW-7, PW-8, and PW-9 were constructed with 8-inch diameter casing and	Yes, we will do this. In summary, the 6-inch-diameter wells are judged capable of meeting the design needs at a lower construction and material cost compared to the 8-inch-diameter wells.

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screen. NW Natural should confirm the recommendation to use 6-inch casing/screen, and provide the rational for reducing the well diameters.	
As indicated in the general comments, evaluations of the specific capacities and well efficiencies of the existing pilot extraction wells should be completed and included in the Draft Final Groundwater SCMs Design. Based on this information and groundwater modeling, NW Natural should make recommendations for modifying extraction well designs to improve well efficiency. Optimizing well design and well efficiency is particularly important given DEQ's general comments about maintaining the long-term operation and effectiveness of the HC&C system due to the heterogeneity of the upper Alluvium WBZ, potential lack of available drawdown, and the potential for well fouling discussed in Section 3.2.2.4. Regarding future installations, DEQ expects NW Natural to run sieves on the material to be screened to select the screen slot-size and filter pack gradation for each extraction well prior to construction.	Yes, as stated previously this analysis will be done and provided in the Construction Design Report. Yes, well efficiency is an important design goal for this project. The well designs for the existing wells will be reviewed in the Construction Design Report. The well screen designs for the existing extraction wells were reviewed and recommended by UOP Johnson based on the grain size data available for the alluvium, which will be further described in the Construction Design Report. Further, it is agreed that advance borings will be conducted to obtain soil samples in the planned Upper Alluvium extraction well screen zones to run sieve analysis prior to finalizing the screen and backfill design of the planned extraction wells.

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	Section 3.2.2.2.2, 2nd paragraph. DEQ believes "DNAPL funnels" are important components of extraction wells, monitoring wells, and "observation wells" located along the portion of Segment 1 where DNAPL occurs. Regarding sealing around the sump, DEQ recommends adding a predetermined amount of slurry to the bottom of the borehole before the well is set in place (i.e., within the outer casing). The amount of sealant should allow for displacement caused by insertion of the well's sump. During placement of the sand pack, in addition to surging the well to settle the sand sealing materials that may have migrated around the funnel and into the sand pack and sump should be removed through bailing.	Yes, this recommendation will be fully reviewed and discussed with the drilling contractor to assess constructability. If the drilling contractor recommends that this is a feasible construction plan, it will be implemented on wells to be installed on Upper Alluvium wells in Segment 1 and any of the Lower Alluvium wells that are to be screened near DNAPL zones.
20	**DEQ Specific Comments, Pages 9 and 10** **Section 3.2.2.2.2, 4th paragraph.** DEQ acknowledges that depending on material type(s), sonic drilling equipment allows retrieval of much of the material in the interval drilled for purposes of visual observation and sample collection. However, for clarification the sonic method does not typically provide "core" (i.e., intact undisturbed material over the drilled interval) as considerable disturbance occurs during drilling, removing material from the	

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casing, and during bagging of the material. This comment also applies to Section 2.1.4.	
Section 3.2.2.3, 5th paragraph. DEQ acknowledges NW Natural's inclusion of DNAPL pumps in the design of upper Alluvium WBZ extraction wells. Certain extraction wells in the lower Alluvium WBZ should also be equipped with the pumps depending on the proximity of DNAPL to the installation (e.g., PW-3-85). Alternatively, NW Natural should discuss the decision framework and time required to add DNAPL pumps to wells where accumulation occurs after construction and system start-up. In addition, there is the potential for DNAPL recovered from extraction wells (e.g., PW-2U/L, PW-3-85) to contain F002 listed hazardous waste. The Draft Final Groundwater SCMs Design should discuss this scenario, including providing material sampling, handling and management procedures.	Yes, wells in the Lower Alluvium may have to be supplemented with DNAPL removal wells if DNAPL is detected during routine monitoring. The type of DNAPL removal well that is currently designated can be installed very quickly through an existing drop tube that is in the extraction well design. This will be further described in the Construction Design Report. The questions regarding potential F002 materials will also be answered in the Construction Design Report.
Section 3.2.2.4, 4th paragraph. DEQ understands using the Aqua Gard system involves a permanent installation on the wellhead and requires a perforated injection pipe to be permanently installed in the extraction well(s). However, it is unclear whether the well-head installation and/or the perforated pipe are incorporated into the well-head design shown on figures 3-7a and 3-7b. The figure should	The same drop tube that will hold the transducer cable

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be reviewed and revised as appropriate. **Section 3.2.2.5.2, 1st paragraph.** As indicated above, DEQ is not aware of NW Natural having provided documentation of changes made to the MODFLOW model from the Interim Design Report onward. As such, DEQ and NW Natural have different understandings regarding the current status of the "approved" MODFLOW model. This is a matter which should be resolved prior to NW Natural submitting the Draft Final Groundwater SCMs Design. **Section 3.2.2.5.2, 2nd paragraph.** DEQ's general comments on the groundwater monitoring plan apply here. **Section 3.2.2.5.2, 3rd paragraph.** DEQ believes temperature and specific conductance provide useful information for monitoring the effectiveness of the HC&C system in the Alluvium WBZ. This information can be used to support groundwater elevation and chemistry data. For example, declines in these parameters measured over time provide evidence river water is being drawn towards the uplands. DEQ acknowledges NW Natural's prioritization of collecting water level and temperature data over specific conductance information. However, DEQ believes specific	will be used for the Aqua Gard treatments. This will be further explained in the Construction Design Report and the drawings will be clarified. Yes, as indicated in the earlier response, the information requested on the current MODFLOW model will be provided in the Construction Design Report. A meeting to discuss the status of the MODFLOW model prior to completion of the Construction Design Report is recommended.

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conductance may be a more sensitive parameter for assessing water quality changes than temperature alone. For example, DEQ understands river temperatures fall above and below groundwater temperatures depending on the season. NW Natural should select a representative subset of performance monitoring wells where temperature and specific conductance data will be collected during HC&C operation.	NW Natural agrees that temperature and specific conductance monitoring of selected wells would provide some interesting information during the first year or so of system operation, but that data is not important from the standpoint of measuring hydraulic capture. However, a plan to provide such information will be included in the Construction Design Report.
Section 3.2.2.5.2, 6th and 7th paragraphs. According to NW Natural, the programmable logic control (PLC) is designed so a unique elevation delta (ΔH) can be assigned to each control well transducer. DEQ understands ΔH represents the elevation difference between the river and groundwater elevation in the control well. In other words, the delta value controls the magnitude of the hydraulic gradient between the river and the HC&C control wells. The higher the ΔH in a control well, the greater the pumping rate needed at the corresponding extraction well. DEQ further understands ΔH is a critical design parameter whose value must be equaled or exceeded at control wells on an average basis for the HC&C system to be effective. As such, ΔH values should be selected to ensure the HC&C system maintains gradient reversals throughout the full	

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	thickness of the Alluvium WBZ. NW Natural indicates recommended ΔH values will be provided during the startup process. However, operation of the HC&C system can be modeled using MODFLOW and the gradients needed to fully contain the Alluvium WBZ can be estimated based on the simulated head differences between uplands installations and the river. DEQ requests the anticipated range of ΔH values be provided in the draft final design document as projected performance criteria, refinement of which will be performed during start-up. DEQ expects the ΔH values to be selected to account for and overcome factors not related to operating the extraction wells (e.g., fluctuations caused by river stage, "drift" in transducer readings).	As stated previously, it is possible to select the ΔH value as requested by DEQ and to use MODFLOW to predict the gradients needed for capture. However, such predictive modeling will not be useful because 17 of the 22 planned extraction wells have not been installed or tested. The water level data that will result from pumping those wells cannot be accurately predicted until the wells have been field tested. This type of analysis is proposed to be done based on testing the entire extraction system and the results provided in the Operations Design Report. This issue is also addressed in the Category 2 responses.
21	**DEQ Specific Comments, Page 10** **Section 3.2.2.5.2, 7th paragraph.** DEQ acknowledges the reasons cited and accepts NW Natural's recommendation to not use monitoring wells below the lower aquitard as control wells. DEQ understands that monitoring wells MW-21-165, MW-18-180, MW-19-180, MW-5-175, WS-14-161, and WS-11-161 will instead be equipped with transducers to monitor water level elevations, assess the influence of the HC&C system below the deeper aquitard, and demonstrate gradient reversal(s) are being achieved and maintained in this zone.	Yes, this will be clarified in the monitoring plan in the Construction Design Report.

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Section 3.2.2.5.2, last paragraph. Piezometers are included in the performance monitoring network to monitor groundwater elevations near and/or under the river. The numbers of existing and proposed piezometers are insufficient to provide water level information across the length of shoreline segments 1 and 2. Two additional piezometer clusters should be constructed offshore from PW-2 and PW-10 locations.	Yes, these will be added in the Construction Design Report.
Section 3.2.2.5.3 (Targost Sampling). DEQ's general comments regarding DNAPL monitoring apply here and Figure 3-10 should be revised accordingly. For clarification, DEQ accepts NW Natural's general approach for assessing individual Targost® sampling areas for the presence of DNAPL prior to HC&C system start-up. However, NW Natural should be advised that finalizing the numbers and locations of baseline Targost® logging locations and/or sampling areas is dependent on compiling evidence of DNAPL occurrence on geologic cross-sections.	Yes, this will be evaluated in the Construction Design Report.
Section 3.2.2.5.3 (Monitoring and Recovery of DNAPL Entering Wells). DEQ approves NW Natural's recommendation to measure	

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DNAPL in monitoring wells daily for the first week and weekly for the first quarter of operation. However, given the uncertainties associated with DNAPL occurrence and movement and pumping the extraction wells, measurements should continue to be made every other week through the first quarter of HC&C system operation. Adjustments to this schedule will be made based on the first three months of DNAPL measurements and subsequent to DEQ's approval. DEQ acknowledges DNAPL may enter an installation due to its placement and construction and accepts NW Natural's recommendation to monitor DNAPL prior to system start-up to evaluate baseline conditions. Under this scenario DEQ believes the goal for baseline conditions should be to establish to the extent practicable a stable situation in the installation (e.g., minimal or uniform DNAPL accumulation). **Section 3.2.2.5.4.** In general, it appears NW Natural's recommendations involve reducing the overall sampling frequency and removing analyte groups from the groundwater monitoring program. The recommendations appear to be based on the amount of existing groundwater data available for the site and the presumption that groundwater data and trends will not be useful in assessing the performance of the HC&C system.	Yes, this revision will be made in the Construction Design Report.

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22 **DEQ Specific Comments, Pages 11 and 12** DEQ has numerous comments on the performance monitoring program which are provided below. DEQ's comments are provided in italics following our understandings of NW Natural's recommendations. • Except for extraction wells, NW Natural proposes collecting samples from all monitoring wells, observation wells, and piezometers, on an annual basis. – *Based on the information presented in the Revised Interim Design Report, DEQ does not approve NW Natural's recommendation to reduce the sampling frequency at all monitoring wells, observation wells, and piezometers to annually. Although DEQ acknowledges a significant amount of groundwater chemistry data has been collected at the site, the focus of groundwater data evaluations has been on a very limited subset of COI (e.g., benzene, total low and high molecular weight polycyclic aromatic hydrocarbons [PAHs]). As such, there is insufficient information available to evaluate NW Natural's recommendation. The current approved sampling frequency for existing installations is semi-annual. In addition, the approved approach to sampling new monitoring wells is to collect four consecutive quarters of samples to establish trends before reducing the frequency. Before the frequency of monitoring, the*	

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suite of analyses, and/or the list of monitoring wells are changed, NW Natural should provide the technical basis for the recommendation(s), including supporting data evaluations, for DEQ's review and approval.	Yes, this will be further discussed in the Construction Design Report.
– *Given the HC&C system will alter hydraulic conditions in the Alluvium WBZ, DEQ requests new and existing monitoring wells, observation wells, and piezometers to be sampled within 3-months of treatment system start-up to assess changes in groundwater trends in response to pumping. DEQ believes trends (or changes in trends) in groundwater chemistry will inform evaluations of HC&C system performance. The initial sampling may coincide with semi-annual sample collection or could be conducted as a separate event. The goal of DEQ's recommendation is to collect two sets of groundwater samples for analysis during the first six months of HC&C operation.*	Yes, this will be added to the Construction Design Report. We are agreeing to revisions for the first year for startup purposes and we understand that DEQ wants to approve any changes to the program, but we believe that the monitoring data will support a reduction in parameters and monitoring frequency as recommended in the design report.
• New monitoring wells will be sampled after installation and annually thereafter. *See comments above.* • Extraction well samples will be collected and analyzed on a "tiered" basis (i.e., monthly for the first year, quarterly for the second year, semi-annually for the third, fourth, and fifth years, then annually).	
– *DEQ approves this approach under the condition that changes in*	We are agreeing to DEQ requested revisions for the

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the sampling frequency will be made based on an analysis of the data collected previously. The data analysis and recommended change in frequency are subject to DEQ's review and approval. • All samples will be analyzed for volatile organic compounds (EPA Method 8260), PAHs (EPA Method 8270C selective ion method), WAD cyanide, and free cyanide. – *Based on the information presented in the Revised Interim Design Report, DEQ does not approve NW Natural's recommendation to limit the suite of analyses to those listed here for "annual" monitoring events. As mentioned above, there is insufficient information available in the Revised Interim Design Report to evaluate NW Natural's recommendation to modify the approved groundwater monitoring program (e.g., remove metals). Before the frequency of monitoring, the suite of analyses, and/or the list of monitoring wells are changed, NW Natural should provide the technical basis for the recommendation(s), including supporting data evaluations, for DEQ's review and approval.* – *Consistent with DEQ's comment to Section 3.2.1.1 (6th paragraph), groundwater samples should be analyzed for total, available, and free forms of cyanide.* • Field measured parameters will include pH, specific conductance, and oxidation reduction potential (ORP).	first year for startup purposes and we understand that DEQ wants to approve any changes to the program, but we believe that the monitoring data will support a reduction in parameters and monitoring frequency as recommended in the design report. Yes, this will be clarified in the Construction Design Report. Yes, this change will be in the Construction Design Report.

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	DEQ understood turbidity was currently included in the list of field measured parameters being monitored during purging. DEQ does not approve the list of field measured parameters referenced above without turbidity. More than any parameter, turbidity provides information regarding the ability of an installation to deliver samples representative of groundwater. This is especially important where COI with a high affinity to organic matter and/or fine-grained material are present, including metals and polycyclic aromatic hydrocarbons. The goal for monitoring well purging prior to sampling should be to achieve a turbidity value of less than 50 NTU.	Yes, this will be clarified in the Construction Design Report.
23	**DEQ Specific Comments, Page 12** • Inorganic indicators of river water will be analyzed for during the initial month of operation on a weekly basis, then monthly during the first six months of operation. – *DEQ approves NW Natural's recommendation under the condition that changes to the monitoring approach will be based on an analysis of the data collected during the first 6-months of operation. The data analysis and recommended change in frequency are subject to DEQ's review and approval.* • The combined influent to the treatment system (not all monitoring wells) will be analyzed for "all of the constituents on the groundwater permit discharge list and any constituents	Yes, this will be added in the Construction Design Report.

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that could affect the operation of the extraction/treatment system." – *DEQ approves this approach. DEQ also concurs with NW Natural's recommendation to use combined influent data to identify parameters which are an issue for the treatment system, and follow-up by sampling individual extraction well(s). As noted by NW Natural, the final parameter list for combined influent will be based on the NPDES permit.* Regarding NW Natural's questions about including "all Gasco and Siltronic COIs" in the monitoring program, DEQ believes the comments provided above address this topic. **Section 3.2.2.5.5.** NW Natural indicates the "…extraction well system will be instrumented for remote monitoring of water elevation and flow." DEQ expects to be able to access remote monitoring displays and data and be copied on alarm notification e-mails. NW Natural should also further explain the following sentence and discuss operational implications: "The system will have automatic alarms that will be triggered for water level changes outside of the set point differential level in the control wells and for sustained extraction well pump shutdowns."	Yes, DEQ will be provided access to remotely view the monitoring displays, and this will be clarified in the Construction Design Report.

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DEQ additionally understands the extraction wells and treatment system will be equipped with automatic alarms. NW Natural should confirm this understanding and clarify whether control wells will also be equipped with alarms alerting system operators the ΔH values are not being met. **Section 3.3.** NW Natural proposed DEQ expedite review of the treatment system design with the goal of approving the system by the middle of June 2011. DEQ became aware of the mid-June timeframe during our review of the Revised Interim Design Report. DEQ informed NW Natural by telephone on June 6, 2011 the proposed timeframe for approving the treatment system would not be met because the design needed to be reviewed in the context of new SCMs design elements, including the interceptor trench and the re-designed portion of the HC&C system along Segment 1. The Interim Design Report presented a water treatment system with a maximum treatment plant flow rate of approximately 400 gpm. The treatment system in the Revised Interim Design Report is based on a "maximum day flow" of 619 gpm. Except for the potential groundwater flows from U.S. Moorings; DEQ understands the treatment system in the Revised Interim Design Report includes the	The functioning of the alarm system will also be clarified in the Construction Design Report.

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	same sources of water as the interim design (i.e., flows from the HC&C system, treatment system process return flows, and the Fill WBZ including the LNG basin). NW Natural should further discuss sources of water to the treatment system and explain the difference in treatment plan flow rates between the two design documents.	The sources of water will be further described in the Construction Design Report.
24	**DEQ Specific Comments, Page 13** **Section 4.** NW Natural informed DEQ by e-mail on August 29, 2011 of its intent to convey treated water into the river via an outfall. NW Natural should be advised this section of the revised interim design does not identify state and/or federal permits that may be required for this work. DEQ expects NW Natural to identify all permits required to install the wastewater outfall in the Draft Final Groundwater SCMs Design.	Yes, this will be done in the Construction Design Report.
	Section 5. DEQ's general comments on the interceptor trench and specific comments to Section 3.3 apply here.	
	Table 3-2. Information regarding all of the aquifer tests completed at the site should be included in the table, included the specific capacities and well efficiencies for each of the wells tested.	Yes, this information will be added to the table.
	Table 3-4. The table should clearly indicate the extraction well(s) associated with each control well. All monitoring wells within the	Yes, the table will be revised, and the DNAPL monitoring plan shown on Table 3-4 is intended to

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portion of shoreline Segment 1 DNAPL occurs should be checked for DNAPL on a monthly basis for the first year of the HC&C operation. In addition, extraction well PW-2L should be monitored for DNAPL.	include all of the monitoring wells in the Segment 1 shoreline for monthly monitoring during the first year of operation.
Table 4-1. Given NW Natural's decision to discharge treated water to the Willamette River via an outfall this table will likely be modified to reflect the need for additional permits.	
Figure 1-2. Property and/or leasehold boundaries should be added to the figure for completeness.	Yes, these will be added.
Figure 2-8. Evidence of DNAPL at GS-09, shown on figures in previous submittals at a depth of approximately -25 feet COP should be added to the figure. DEQ considers the figure to be incomplete without this information being shown.	Yes, the boring log information will be reviewed to determine if the figure should be revised and the findings discussed in the Construction Design Report.
Figure 2-9b. Equipotential contours based on groundwater water levels measured by Siltronic on May 19, 2010 should be added to the figure completeness. DEQ considers the figure to be incomplete without this information being shown.	Yes, these contours will be added.
Figure 2-14. The interpreted width of the Siltronic cVOC plume should extend beyond the MW-5 monitoring well cluster as	Yes, this change will be made.

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	detections of cis-1,2-dichloroethene in monitoring well MW-5-100 exceed 300 ug/L. **Figure 3-4a.** The description of the large DNAPL body in the fill unit beneath the Koppers, Inc. leasehold and NW Natural's Liquid Natural Gas (LNG) plant is incorrect. As indicated in DEQ's March 10, 2010 comments to the RI Report and Risk Assessment, there is evidence of DNAPL movement laterally to the north and northeast, and vertically downward. Based on the information documented in the March 10th letter, DEQ determined the DNAPL body under the former process areas represents a large mass of material with significant migration potential. The figure should be revised accordingly. **Figures 3-7a and 3-7b.** The "Well Flange – Top" details on both figures should be revised to show an access port for the permanent Aqua Gard system piping. In addition, Figure 3-7a should be revised to show a DNAPL funnel at the bottom of the screen interval. However, DEQ notes lower Alluvium WBZ extractions wells may be equipped with DNAPL funnels as well.	This request to revise the Figure will be reviewed and addressed in the Construction Design Report. The Figures will be labeled to show which access port will be used for the Aqua Gard injections, and the funnel will also be added.
25	**DEQ Specific Comments, Pages 13, 14, and 15** **Appendix E, Treatment Plant Design** DEQ does not approve the treatment plant design without	Yes, all DEQ requests related to the Treatment Plant Design will be addressed in a separate submittal to DEQ. NW Natural requests that DEQ review the

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information being provided about waste stream identification and management. Although Drawing FD-1 appears to show each waste-streams generated in the water treatment process, identified the type of waste media (vapor, solid, liquid), and provides estimates of annual volumes; DEQ's March 26, 2010 letter commenting on the Interim Design Report requested NW Natural to determine the regulatory status of each waste-stream (solid waste, hazardous waste), provide the basis for the regulatory determination (e.g., regulatory citation, knowledge of process, sampling data), and a plan for managing the material(s). DEQ's comments and questions on the treatment plant design are provided below. • DEQ understands sludge and water were produced during the treatment system pilot study and were managed consistent with DEQ's March 27, 2008 letter regarding investigation derived waste. As requested in our March 26, 2010 letter commenting on the Interim Design Report, NW Natural should provide documentation regarding solids IDW management for DEQ's information and completeness. • The treatment plant is designed on Max-Day flows (619 gpm), but process pumps are sized for Max-Hour flows (805 gpm). NW Natural should clarify how treatment processes can	updated treatment plant design report on a separate expedited track from the Extraction System Construction Design Report. DEQ approval would enable ordering of the long-lead components of the treatment system. The current plan is to submit the updated treatment system design document to DEQ in November.

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operate effectively above their design flow rates, or if there is enough storage within the plant to never operate any of the treatment processes above 619 gpm. For example, are the 21,000-gallon air stripping tanks going to be used to equalize flow and manage potential Max-Hour flow rates? • The air sparging tanks will oxidize some metals as a consequence of elevating the pH and due to air sparging. DEQ expects this material to be identified and characterized for purposes of the treatment system waste-stream determination, including volume estimates. • The contained-in concentrations listed in Table 2 do not apply to treatment system sludge(s). Environmental media, including soil, sediment, and groundwater contaminated by releases from Siltronic's Former UST System, are impacted by an F002 listed hazardous waste. Solid waste such as treatment system sludge, with detectable concentrations of cVOCs resulting from the treatment of groundwater containing cVOCs is a mixture of a solid waste and a listed hazardous waste and should therefore be managed as hazardous waste. • Manufacturer's information should be provided for the polymers proposed for use in the treatment system. NW Natural should also indicate whether they are different from those used in the pilot test.	

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• NW Natural proposes to use a composite sampler to collect samples of treatment plant effluent for analysis; however the rate and frequency of the sampling and the analyte list are not specified. NW Natural should note the rate and frequency and analyte list must be consistent with the NPDES permit. • NW Natural's basis for selecting hydrogen peroxide or sodium hypochlorite in the cyanide destruction process should be provided. In addition, NW Natural should clarify whether sodium hypochlorite has been tested with site groundwater previously. • The Max-Day flow rates shown in the Appendix A mass balance table total 668 gpm, which does not agree with the Max-Day flow rate of 619 gpm in Table 1. NW Natural should review this information, reconcile the values, and revise the appendix or table accordingly. DEQ notes the Table 1 value is referenced in the Section 3.3 of the Revised Interim Design Report. As such, changes to the table should also be made to the main body of the Draft Final Groundwater SCMs Design. • DEQ requests clarifying information on what the "Initial" column represents in the mass balance table. • Oil water-separators are not shown on Drawing FD-1 in Attachment B. NW Natural should include the units in the process flow diagram, including their associated daily	

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quantities; or provide the basis for not showing them on the drawing. • Drawings FD-2, FD-3, and FD-7 in Attachment B should be revised to include air stripping vapor-phase carbon treatment units. • Drawing FD-3 shows that pretreated water from Siltronic may be introduced into the NW Natural air stripper instead of after the air stripper. From DEQ's review of the treatment system design this appears to the only place in the document where this possibility is indicated. NW Natural should confirm the correctness of the drawing and if so, describe under what conditions this might occur. • Drawing FD-4 appears to show vapor venting from the CN destruct tanks into the treatment building's interior atmosphere. Alternatively, the drawing may show vapor venting to outside air. Clarification should be provided, and in either case NW Natural should explain how hydrogen cyanide in vapor has been considered in the design. • The pH adjustment step using sulfuric acid after the CN destruct tank appears to be missing on FD-4 and FD-7. The drawings should be reviewed and revised as appropriate.	

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26	**DEQ Specific Comments, Page 15** **Appendix J, Fill WBZ Interceptor Trench Design and Drawings** **Excavation Limits.** The stability of the trench should be evaluated along an alignment set-back from the top-of-bank and near the extraction wells.	DEQ's request to redesign the Fill WBZ interceptor trench and move it to the other side of the extraction wells is addressed in the response letter to which this is attached.
	Sheet Sections. Manufacturer's information and specifications for the Shoreguard CL-9900 Rigid Vinyl Sheet Piling should be provided in the design package. A detail showing the joint between panels of the vinyl sheet pilings should also be provided with information indicating whether the joint is sealable and if so by what method(s).	Yes, this will be addressed in the Construction Design Report.
	Clay Barriers. The clay barriers must be compatible with MGP tar and/or oil likely to be encountered along the trench alignment. Documentation of compatibility through laboratory testing and material specifications should be provided.	Yes, this information will be addressed in the Construction Design Report.
	Excavation. Manufacturer's information and specifications for the "Bio-Polymer" should be provided in the design package. During trench construction excavated materials are recommended for off-site removal and disposal. A contaminated material management plan for the project will need to be prepared and submitted to DEQ	Yes, this information will be addressed in the Construction Design Report. Yes, a plan for materials management will be prepared.

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for review and approval as part of the construction documents package.	
Alignment. The alignment and sequence trench construction should be evaluated consistent with DEQ's general comments.	DEQ's request to redesign the Fill WBZ interceptor trench and move it to the other side of the extraction wells is addressed in the response letter to which this is attached.
Drawings S1, S2, and S3. According to Section 3.2.2.1 of the Revised Interim Design Report, the interceptor trench is intended to fully penetrate the fill unit and capture all of the groundwater in the Fill WBZ. The "Geotechnical" section of the Appendix J indicates that, "Below a thick layer of manmade fill the native soils consist of alternating layers of silt - saturated, loose to medium dense, sand and silty sand. The profile for the interceptor trench was selected on the basis of the interpreted contact between the manmade fill and the initial layer of native SILT and SANDY SILT." Drawings S1, S2, and S3 indicate the bottom of the trench will be set just below the contact between the "Bottom of Existing Fill" and the "Top of Sand." The drawings should be reviewed against the design criterion for the trench profile. Documentation of the material type along the bottom of the proposed trench alignment should be provided in the appendix and the alignment should consider DEQ's general comments.	Yes, the drawings will be reviewed and this comment addressed in the Construction Design Report.

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27	**DEQ Specific Comments, Pages 15 and 16.** **Appendix K – Well Construction and Development Plan** **Section 2.** This section should be modified for the draft final submittal to reflect DEQ's comments made to the main body of the Revised Interim Design Report, including our general comments and specific comments regarding Section 3.2.2.2.2. **Section 3.** Besides pH, specific conductance, and temperature, and consistent with our comments to Section 3.2.2.5.4 of the Revised Interim Design Report, DEQ expects turbidity to be monitored during observation/monitoring well development. More than any other field measured parameter, turbidity provides information regarding the ability of an installation to deliver samples representative of groundwater. This is especially important where COI with a high affinity to organic matter and/or fine-grained material are present, including metals and polycyclic aromatic	Yes, those comments will be addressed per NW Natural's earlier responses to DEQ's General and Specific Comments. Yes, please refer to NW Natural's previous response to this comment.

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hydrocarbons. The goal for monitoring well development should be to achieve a turbidity value of less than 50 NTU.	
Section 4. For clarification, NW Natural should manage soil and water investigation-derived waste (IDW) with detectable concentrations of cVOCs associated with releases from the Former UST System with DEQ's involvement and consistent with DEQ's March 27, 2008 letter. The March 27th letter lays-provides procedures for managing soil and water IDW contaminated by MGP constituents and/or cVOCs on the NW Natural and Siltronic properties. DEQ's April 8, 2010 letter discusses managing IDW contaminated only by MGP waste or constituents.	Yes, these comments will be reviewed by both NW Natural and Siltronic and addressed in the Construction Design Report.
NW Natural should be advised the procedures for managing, handling, and disposing of contaminated environmental media, is subject to change in the future. As part of planning for the Gasco Sediment Project, a Special Waste Management Plan (SWMP) will be prepared to establish criteria and procedures for managing and disposing contaminated soil and/or sediment offsite. The SWMP is being developed because future uplands and in-water removal/remedial actions have the potential to produce large volumes of contaminated material which could be managed through offsite disposal in state-permitted landfills that meet Subtitle D liner	NW Natural requests additional information on the status of the SWMP and would appreciate an opportunity to review the draft document.

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	requirements. Furthermore, depending on the constituents present and their concentrations, offsite management could involve special handling of contaminated media (e.g., treatment) prior to disposal.	
28	**DEQ Specific Comments, Page 16** **Appendix O – Sampling and Analysis Plan** **Section 3.1.** Consistent with DEQ's comments to Section 3.2.2.5.4 of the Revised Interim Design Report, DEQ expects turbidity to be monitored during observation/monitoring well purging. Prior to collecting samples for analysis, the goal for purging should be to achieve a turbidity value of less than 50 NTU. DEQ also expects ORP to be added to the list of field parameters for consistency with Section 3.2.2.5.4.	Yes, these will be added, as stated, in NW Natural's previous response to these requests.
	NW Natural indicates that, "After the water quality parameters have stabilized, the sample will be collected directly from the dedicated tubing or disposable bailer into the sample container." Additional information should be provided regarding actual sample collection procedures, including but not limited to descriptions of which samples will be collected using dedicated tubing or disposable bailers, and methods used for transferring samples from sampling equipment to containers. For example, will cVOC samples be collected from the bailer, and if so will the bailer be equipped with a	Yes, this information will be added to the Construction Design Report.

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bottom check-valve (preferred) or will the sample be poured from the top.	
Section 4.1. DEQ understands from Section 3.1 that dedicated or single-use sampling equipment will be used for sample collection. This section suggests this might not be the case as groundwater sampling equipment is discussed in terms of being decontaminated. NW Natural should clarify this information. Given the significance of groundwater contamination at the site and potential presence of DNAPL and/or sheen in monitoring wells, DEQ recommends that NW Natural rely on sampling equipment dedicated to an installation or single-use disposable bailers or tubing to the maximum extent practicable.	Yes, NW Natural agrees and will clarify as needed in the Construction Design Report.
Section 5.3.2.1.3. DEQ recommends that if ice is used to cool samples during shipping, the ice be placed in durable sealable plastic bags to prevent leakage during transport. In addition, NW Natural should clarify whether a thermometer will accompany samples in each shipping container, or whether the laboratory will measure sample temperatures after receipt.	Yes, these clarifications will be added to the Construction Design Report.

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	Section 5.3.2.1.4. NW Natural should confirm DEQ's understanding that field quality assurance samples will be collected daily during sampling events.	Yes, this clarification will be added to the Construction Design Report.
29	**EPA General Comments, Pages 1 and 2** **General Comments** 1. EPA has several specific comments on sections throughout the draft Final Design Report that relate to the following topics. a. Capacity of the extraction wells to pump over the long-term seasonally and as a result of anthropogenic changes to the surface recharge that include site paving and a newly proposed (not in previous design documents) Fill Water Bearing Zone (WBZ) Interceptor Trench. b. Meeting the remedial action objective (RAO) of complete prevention of discharge of upland groundwater to the Willamette River. The specific comments below point to a need for further evaluation of long-term extraction well production capacity as well as deficiencies in the performance monitoring that, at its current design, presents significant uncertainty in demonstrating hydraulic control of upland groundwater discharge to the Willamette River and prevention of recontamination of riverbank and in-river sediment post cleanup.	Anchor QEA disagrees with this characterization. The extensive data collection and modeling efforts completed at DEQ's request provide substantial justification for the current design. We understand that EPA is still reviewing the conclusive findings of hydraulic capture demonstrated in the May 25, 2011 Anchor QEA report *Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Drive*

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	Well Pumps and recognize that these comments do not necessarily reflect the findings of that report. Further, the characterization of the lower silt as continuous is not correct. The lower silt does not extend under the river so is not laterally continuous. Regardless, the Construction Design Report will restate that NW Natural is committed to achieving hydraulic containment, and it will identify contingencies that could be implemented if needed, such as additional extraction wells.
2. The document is void of any discussion and analysis of how well specific capacity (determined from the 2010 pumping tests) relates to available drawdown and what average extraction rates and drawdown at these rates are necessary and if they are achievable at each extraction well for long-term hydraulic control of groundwater discharge through the upper and lower alluvium.	This general comment is addressed in responses to EPA's specific comments.
3. The modeling presented in the report to support the design needs to incorporate all of the elements of the design. For	This general comment is addressed in response to EPA's specific comments.

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	example, two significant elements are not presented in the simulations, namely 1) the interception trench in the Fill WBZ and 2) changes in surface characteristics such as paving, which will decrease the recharge to the alluvium water bearing zones. EPA has the following specific comments related to this document.	
30	**EPA Specific Comments** 1. Section 2.1.4, pages 9 and 10: NW Natural presents profiles showing the extent of total and dissolved free cyanide, yet there is no substantive discussion about these profiles. Total cyanide concentrations appear very high adjacent to the U.S. Moorings site. More discussion should be presented in the document related to these figures and how this chemical of interest is being addressed in the overall proposed Hydraulic Control and Containment design. 2. Section 3.1.3, page 13, paragraph 1, 5th sentence: There does not appear to be supportive analysis to provide a basis for the assumption that when a well is shut down for maintenance, other adjacent wells will be capable of increasing their pumping rates to maintain capture. To fully support this assumption, NW Natural should evaluate this analytically and using specific capacities, available drawdown, well yields necessary for capture as derived from modeling simulations, and Segment 2	Yes, more discussion will be provided in the Construction Design Report. Yes, this type of analysis will be done and provided in the Operations Design Report and is included in the Category 2 responses.

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constant-rate and VFD testing. Based on a preliminary review of available drawdown at current conditions, sustainable extraction rates in the upper alluvium wells are greatly limited with no additional capacity to increase pumping rates to support the loss of an adjacent shutdown well.	
3. Section 3.2.1.4: Figures showing hydraulic response within the primary water bearing units (Fill, Upper Alluvium, Lower Alluvium above the confining layer and Lower Alluvium below the confining layer) should be presented in groundwater modeled head maps and particle capture maps (both in plan and cross-section view) that illustrate extraction well influence based on long-term, sustainable, pumping rates (derived from pumping test results). These illustrations are an important spatial assessment to provide certainty that hydraulic control via extraction wells can be maintained. Currently, only particle capture is presented in plan view in Figure 3-2 with all of the particles originating in the hydraulically upgradient direction. This one figure does not provide a full evaluation of hydraulic control and capture in each of the three water bearing zones since it is unknown what unit the particles are placed vertically. As a result, it is possible that deeper alluvium flow is not evaluated in this particle track distribution, and may escape capture.	Yes, these additional figures will be provided in the Construction Design Report.

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4. Section 3.2.1.4, page 19, paragraph 1, last bullet: Additional figures, as a result of additional modeling runs, as referenced in the bullet, do not appear in the report, or Appendix F where the groundwater modeling documents are presented. These simulations may be critical to the final design and should be provided for review.	The bullets reference specific documents prepared for ODEQ. These will be appended to the model documentation in the Construction Design Report.
5. Section 3.2.1.4 page 20: Groundwater inflows shown in the table need to be broken out to present the components of flow in the horizontal as well as vertical direction. For instance, NW Natural should present how much flow contribution the Fill has to the Upper Alluvium and the Upper Alluvium to the Lower Alluvium. This will help quantify the amount of flow lost to the alluvium as a result of future site paving and the interceptor trench constructed in the fill WBZ. NW Natural should evaluate these changed conditions using the model and present the results (see General Comment 3).	Yes, this table will be revised and further explained in the Construction Design Report. Yes, this will be done and the findings described in the Construction Design Report.
6. Section 3.2.1.4, page 20: Groundwater inflows shown in the Model Water Inflow table estimate 305 gallons per minute (gpm) of flow for the Upper Alluvium and 650 gpm of flow for the Lower Alluvium above the aquitard, while nothing is estimated for the Lower Alluvium below the aquitard. Given the inflow values, and the 10 extraction wells planned for each of the water bearing units, it would appear that each Upper Alluvium well	

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needs to sustain a pumping rate of 30.5 gpm and each Lower Alluvium Well a rate of 65 gpm to effectively control and capture groundwater discharging to the Willamette River. However, pumping test data presented by NW Natural in their March 2011 Segment 2 Capture Zone Field Test Report suggest that Upper and Lower Alluvium wells will have difficulty meeting and/or sustaining these flow rates over the long-term (Upper Alluvium Well P8-39 shows a long-term sustainable flow rate of 2 gpm and Deeper Alluvium Well P9-92 is estimated by EPA to have a long-term sustainable flow rate of 55 gpm). This presents a discrepancy between the groundwater discharge to be controlled and the total sustainable capacity of the extraction wells based on the pumping tests that should be addressed (see Specific Comment 2 for suggestions on evaluating this issue).	Yes, these issues related to the table on page 20 will be addressed in the Construction Design Report.
7. Section 3.2.1.4, page 21, paragraph 1 bullets: The numerical model was further modified for the Final Design Report, but there is no discussion or documentation that presents details and results of these modifications. For example:	Yes, information requests 7a, 7b, and 7c, will be provided in the Construction Design Report.
a. Model area was extended to include U.S. Mooring site – NW Natural should explain the reason for this and what the results of this extension are to the modeled flow and calibration.	
b. Grid spacing was redefined from 40 x 40 ft to 20 x 20 ft –	

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NW Natural should explain how this refinement impacted calibration and/or simulations. c. Hydraulic conductivity of the shallow alluvium was modified – NW Natural should present both the previous and newly modified distribution of the hydraulic conductivity assignments spatially on a map. 8. Section 3.2.1.4, page 21, last paragraph: NW Natural states that the model was not modified to reflect the numerous slug test results that indicate the Fill WBZ has an average hydraulic conductivity of less than 1 ft/day. Rather, NW Natural maintained a 10 ft/day assignment to the Fill WBZ in the model. The justification for this is the observation that the model calibrated well using the higher hydraulic conductivity and that a higher hydraulic conductivity assignment is more conservative from the standpoint of determining flow to the proposed interceptor trench and sizing of the pump and treat system. However, EPA believes a sensitivity analysis is needed to assess the degree of influence the lower hydraulic conductivity will have to the extraction system design. Since model simulations will be used to evaluate capture of groundwater at assigned flow rates, the extraction wells currently may show higher than actual pumping capacities as a result of higher recharge assigned in the model. NW Natural should re-run model simulations at	This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.

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hydraulic conductivities determined from site data and with the additional design elements (interceptor trench, paving, etc.) to re-evaluate extraction well placement, capacity limitations, and overall design.	
9. Section 3.2.1.4, page 22, last paragraph: Transient model simulations using river stage data and results from the variable rate pumping tests conducted in April 2011 to determine long-term pumping rates necessary for tidal and stage changes has not been completed (see last paragraph in Section 3.2.1.4). This analysis and its results could impact the final design and therefore should be provided for agency review before approval of the draft final design report.	Yes, the existing model will be run using the data from the April 2011 tests, and the results will be provided in the Construction Design Report.
10. 11. Section 3.2.1.5: The presentation of groundwater flow vectors in Figures 3-3a continue to be difficult to visualize. These flow vectors should be presented in a more conventional approach, where a vector at the center of each finite difference cell is presented based on surrounding water levels showing the direction and magnitude of flow.	Yes, this comment will be addressed in the Construction Design Report. However, these figures show the direction and magnitude of groundwater gradients. Breaking the flow into vertical and horizontal components was done to illustrate the potential effects of gradients on DNAPL movement. This will be lost if the figures are changed to show groundwater flow vectors.
11. Section 3.2.1.9: EPA provided comments to NW Natural concerning the results summarized in the March 2011 *Segment 2 Capture Zone Field Test Report*. The comments noted issues with the assessment of capture over long-term seasonal changes and whether or not some portion of groundwater gradient reversal	

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was being incorrectly assigned to extraction well capture. EPA is now in receipt of NW Natural's response to these comments and will provide a separate comment set related to the NW Natural's responsiveness and any additional analysis presented in *NW Natural's May 2011 Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Driver Well Pumps* report.	
12. Section 3.2.1.9, pages 25-26, last paragraph: It is unclear what evidence NW Natural has to support the qualifier "short-term" in the last sentence and therefore this text should be deleted. This qualifier implies long-term (duration undefined) extraction in the alluvium wells will eventually capture water in the Fill, which has not been demonstrated in 72-hr test data from extraction well PW-7, PW-8, and PW-9. More likely, extraction under long-term, steady-state conditions will reach a recharge boundary from the River (seen in the PW-3 testing and evaluated in the April 28, 2008 *NW Natural Gasco, Pump Test Analysis and MODFLOW Model Summary*) that will dampen any influence the alluvium wells will have on the Fill WBZ over the long-term. This is significant, because it points to the immediate need to control discharge in the Fill WBZ, where most of the contaminated water exists, rather than rely on some long-term influence that may, or may not occur as a result of alluvium extraction well operation (see specific comment #14 for issues	DEQ's request to redesign the Fill WBZ interceptor trench and move it to the other side of the extraction wells is addressed in the response letter to which this is attached.

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related to delaying control of the Fill WBZ).	
13. Section 3.2.2.1: The Fill WBZ Interceptor Trench is a newly proposed design that, from the text provided, does not appear to have been fully evaluated regarding the groundwater flow it will intercept. NW Natural should:	
a. Provide the full analysis, including calculations and assumptions for the 20 gpm estimate of flow from the Fill WBZ into the length of the proposed trench. An estimate of the flow, if 10 ft/day is used for hydraulic conductivity (as it currently is in the updated model; see specific comment 8), should be provided.	Yes, this will be provided in the Construction Design Report.
b. Provide a basis that the trench location will intercept all fill groundwater discharge. For instance, the layout of the trench appears to assume the groundwater gradient is straight to the river and no groundwater exists within a measurable distance (~25 ft) of the northern property boundary. This assumption may be the result of data gaps than actual site gradient conditions. It appears some water flow in the Fill WBZ could escape capture and flow to the adjacent U.S. Mooring site based on the current design. In fact, during the remedial investigation at U.S. Moorings completed by the USACE, cyanide has been detected several hundred feet into the southern	Additional characterization of hydrogeology and the nature and extent of contamination is needed before the design of the Interceptor trench could be

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portion of the Moorings facility. Analytical and/or numerical modeling simulations should be prepared to evaluate the potential need to extend the trench footprint. c. No analysis of how this intercepted fill water, that naturally recharges the Upper Alluvium, will affect the sustainability (available drawdown) of the Upper and Lower Alluvium extraction wells. Analytical and/or numerical modeling simulations should be prepared to evaluate this potential impact.	reevaluated regarding potential groundwater discharges to the U.S. Moorings site. However, the Construction Design Report will show that the interceptor trench system will be constructed to be capable of adding a section of trench if needed following the additional characterization. This Modeling request is recommended to be conducted in preparation of the Operations Design Report following installation and testing of the complete extraction system and is addressed under the Category 2 responses.
14. Section 3.2.2.1, page 27, last paragraph: Deferring the interceptor trench construction to the time when in-river sediment and riverbank cleanup occurs presents significant delays in addressing capture of contaminant flux in the Fill WBZ. As noted from the pumping tests (see specific comment 12), the alluvium wells do not influence and capture flow through the Fill WBZ. Thus, delays in the trench design will allow contaminated flow through the Fill WBZ to enter river sediments for an extended period of time while extraction from the alluvium wells occurs. NW Natural points to the observation	DEQ's request to redesign the Fill WBZ interceptor trench and move it to the other side of the extraction wells is addressed in the response letter to which this is attached.

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that flow through the fill is less than 10 percent of the anticipated total flow from the alluvium pump and treat system, but this percentage has not been supported with any analysis (see specific comment 13a). Furthermore, the sequencing of the steps starting with alluvium extraction, then interceptor trench construction/in-river work should be evaluated using the groundwater model to predict any potential issues with construction interferences and sediment recontamination.	
15. Section 3.2.2.2.1, page 28, last paragraph, item #4: NW Natural should provide the reference to analysis, or modeling, that supports this statement.	Yes, this will be provided in the Construction Design Report.
16. Section 3.2.2.2.1, page 29, first paragraph: NW Natural should provide the quantitative data and analysis that supports the proposed placement of the screen intervals. Statements "shallow enough" and "deep enough to allow for sufficient drawdown to attain the pumping rates needed for gradient control" are not quantitative enough for a 100% design level document. Actual quantities of pump and screen settings, average seasonal available drawdown, and anticipated individual well specific capacities should be provided on a table and checked against pumping rates deemed necessary for gradient control.	Yes, this will be provided in the Construction Design Report.
17. Section 3.2.2.2.1, page 30, first full paragraph: NW Natural should provide the extraction rates assigned to each extraction	Yes, this will be provided in the Construction Design

Category 1 Agency Requests to be Addressed in Construction Design Report	NW Natural Response
well in the model that represents this capture. See specific comment 3 for additional analysis/presentation recommendations.	Report.
18. Section 3.2.2.2.2, page 31, second paragraph: EPA disagrees with NW Natural's statement that well construction of extraction wells PW-3, PW-7, PW-8 and PW-9 were appropriate. EPA believes the gradation of the 10-20 filter pack includes too small a gradation for the selected 0.035 inch slot size. Although sanding (filter pack entering the screen) was not an issue during development and/or pumping of these wells, the lower end of this sand gradation, may have plugged the screen slots and contributed greatly to the lower efficiency (well losses) seen in these wells.[4] NW Natural should reconsider its pack selection and choose a filter pack gradation that does not reach the size of the screen slots. Furthermore, the screen intervals appear very short and only partially penetrating the water bearing zones to be controlled. This partial penetration further exacerbates well losses and effectiveness of capture. NW Natural should reconsider its well design to reduce well losses as much as possible.	Yes, these comments will be addressed in the Construction Design Report, as stated in the responses to similar DEQ comments.
19. Section 3.2.2.5.2, pages 35-37, last paragraph starting on page 36:	

[4] Based on EPA's analysis of pumping test data, the wells appear to average an efficiency of 20% which is far below a properly designed, constructed and developed well, which typically averages 70 to 80% (see Groundwater and Wells, Driscoll, 1986).

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Capture assessment appears severely limited and simplistic. For instance, the control wells are too close to pumping wells and represent only gradient conditions between extraction wells. This does not appear sufficient to characterize complete hydraulic control of groundwater discharging through the Upper and Lower Alluvium to the Willamette River. NW Natural should include more wells, including offshore piezometers, in the real-time control of pumping rates and assessment of capture.	Yes, the Construction Design Report will include additional monitoring wells and piezometers. Please refer to NW Natural responses to DEQ general and specific comments. To clarify, each extraction well can be assigned only one control well, so the additional monitoring wells and piezometers will be used to evaluate capture in real time but will not be control wells.
20. Section 3.2.2.5.2, page 37, second full paragraph: It is uncertain when wells instrumented with transducers will be evaluated to verify gradient reversal has occurred in deeper portions of the alluvium water bearing zones as measured by the offshore piezometers and upland wells. If not performed in real-time, it would appear to not meet the intent of the RAO of complete hydraulic capture of groundwater discharge through the site.	
21. Section 3.2.2.5.2, page 38, first paragraph (continued from previous page), last sentence: As noted in specific comments 2, 5 and 6, NW Natural should evaluate available drawdown and individual well specific capacities based on the available well test data to support the assumption that higher pump rates in extraction wells are achievable to capture flow in the deep alluvium below the aquitard. At the current design, there is	

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	significant uncertainty that control in the Lower Alluvium beneath a relatively continuous aquitard can be achieved with partially penetrating wells in the Lower Alluvium above this aquitard. This uncertainty stems from the following: a. A lack of data and analysis (analytical or numerical modeling) to support this assumption. b. The inefficiencies coupled with available drawdown limitations in the existing extraction wells to realistically increase flow rates significantly enough to indirectly capture deeper groundwater discharging beneath an aquitard.	Anchor QEA disagrees with this characterization. The extensive data collection and modeling efforts completed at DEQ's request provide substantial justification for the current design. We understand that EPA is still reviewing the conclusive findings of hydraulic capture demonstrated in the May 25, 2011 Anchor QEA report *Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Drive Well Pumps* and recognize that these comments do not necessarily reflect the findings of that report. Further, the characterization of the lower silt as continuous is not correct. The lower silt does not extend under the river so is not laterally continuous. Regardless, the Construction Design Report will restate that NW Natural is committed to achieving hydraulic containment, and it will identify contingencies that could be implemented if needed, such as additional extraction wells.
31	**EPA Comments on Appendix J** **Comments on Appendix J (Fill WBZ Interceptor Trench, Design Report, Drawings and Specifications):** **General Comments**	

Attachment B
Gasco Source Control Design Report
Category 1 Responses to DEQ and EPA Comments

Category 1 **Agency Requests to be Addressed in Construction Design Report**	**NW Natural Response**
1. Based on the design report, the document is to serve as a project design report which provides the "technical and logistical information" for the construction of the interceptor trench. The document and drawings state the basic design concepts and provide good illustrations of the construction details. However, the specifications noted on drawings S9 and S10 imply that: "The interceptor trench and appurtenances are… solely the contractor's responsibility to determine the construction procedures, equipment and sequences, and ensure the completed functionality of the system resulting from construction." This implies that a final design will be prepared that describes the contractor's means and methods. EPA requests the opportunity to review the final design.	This statement was not intended to imply that another design will be prepared.
Specific Comments 1. Wall Design, Excavation, Page 2 of text: This section states that "the excavation support method considered for the interceptor is a combination of partial open cut, to a limited depth, and a specialized highly viscous fluid, a Bio-Polymer." However, no details are provided for this excavation sequence and, as noted in the general comments, it is implied that a final design will be prepared that describes the contractor's means and methods. EPA requests the opportunity to review the final design.	The Fill WBZ interceptor trench design was submitted as a final design, and no additional design reports were planned. However, if EPA has additional questions about the current design, please inform DEQ and NW Natural.

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Gasco Source Control Design Report
Category 1 Responses to DEQ and EPA Comments

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2. Drawing S10 – Products: There are no specifications listed for the Bio-Polymer slurry and slurry enzyme breaker. If these materials are to be provided by the contractor it should be stated as such, with some performance requirements. 3. Drawing S9 and Drawing S10 – Quality Control: The quality control requirements noted are very minimal. A more formal specification should be provided in the final design.	This information will be provided in the Construction Design Report. NW Natural would appreciate a clarification on the type of information requested by EPA.

Category 2 Agency Requests to be addressed in Operations Design Report	NW Natural Response
1 **DEQ General Comments, Page 8** • Using the MODFLOW model updated to include the results of Segment 2 pilot extraction well tests, to simulate HC&C system operation under seasonal operating extremes of groundwater levels and river stage. The results of the simulation should be evaluated in terms of the available drawdown for each extraction well included in the Revised Interim Design Report. The pump placement elevation(s) implied by the schematic design drawings provided in the revised interim SCMs design (see figures 3-7a and 3-7b) should also be utilized in the evaluation. The specific capacities determined for existing extraction wells should be incorporated into the evaluation for purposes of comparison.	As stated in Appendix A, about 10 percent of the agency requests require additional groundwater modeling and other analyses for the purpose of predicting the hydraulic performance of the completed extraction system to enable potential revision of the current extraction system well spacing, screen depth, and system operational parameters. We believe that the comments which request additional studies and analysis can be resolved in a more effective and efficient manner through post-construction testing. The MODFLOW model has been successfully used for extraction system design, and the April 11 VFD test results show that the system will work. Further predictive model runs using data from only 5 of the total planned 22 wells will not provide more reliable information than we already have. Data from system-wide pumping test of the completed well system will provide better input for the requested modeling, and the results of these model runs will be evaluated in the Operations Design Report to confirm or refine the performance of the extraction system. The Construction Design Report will describe the types of contingency measures that could be taken if testing of

Category 2 Agency Requests to be addressed in Operations Design Report	NW Natural Response
	the completed system indicates that complete capture is not being attained.
2 **DEQ General Comments, Pages 8 and 9** The results of transient MODFLOW simulations and the extraction well design evaluation(s) should be included in the Draft Final Groundwater SCMs Design. The simulations and well design evaluations might identify operational scenarios which could prompt modifications to the HC&C system (e.g., addition of extraction wells). The draft final SCMs design document should discuss these scenarios in terms of potential future contingency measures. DEQ's request for transient groundwater simulations made here is consistent with the March 26, 2010 letter which indicates the HC&C system, "…will need to accommodate a dynamic system influenced by seasonal changes in natural recharge, river stages and tidal influence," and recommends that, "…NW Natural run the MODFLOW model in a transient state to verify the model's ability to simulate changing groundwater flux and hydraulic head conditions resulting from these influences." Furthermore, DEQ's January 11, 2010 letter commenting on the Segment 2 Test Plan informs NW Natural that, "…final data interpretations, conclusions, and analysis, including the results of numerical modeling, should be fully	For the reasons previously stated in Appendix A, it is proposed that further predictive MODFLOW model runs be completed following construction, and it also advised that testing of the entire extraction well system be done and reported in the Operations Design Report.

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	integrated in the HC&C system final design."	
3	**DEQ General Comments, Page 9** **Uplands Source Control and the In-water Sediment Remedy.** Groundwater SCMs are being designed to prevent migration of contaminated groundwater from the uplands to the Willamette River by controlling and containing groundwater in the Fill WBZ and Alluvium WBZ. In addition, NW Natural proposes the Fill WBZ and Alluvium WBZ SCMs as elements of the in-water sediment remedy being overseen by EPA. The Revised Interim Design Report does not discuss how the long-term sediment remedy objective of achieving and maintaining gradient reversals under the river will be reconciled with the source control objective of minimizing DNAPL movement. The Draft Final Groundwater SCMs Design should discuss this scenario fully, including the operational priorities of the HC&C system in the context of the in-water remedy. For example, in the absence of an in-water remedy, the operational and performance objectives of the HC&C system are dictated by uplands groundwater source control. NW Natural should discuss how the operational objectives of the system might change during and after implementation of the in-water remedy. NW Natural should note that DEQ's comment regarding the long-term operation/effectiveness of the HC&C system applies here as achieving gradient reversals for the in-water project would require	For the reasons stated in Appendix A, the Construction Design Report will address this issue, and the quantitative criteria for operating the system will be developed in the Operations Design Report, following construction and testing of the system.

Category 2 Agency Requests to be addressed in Operations Design Report		NW Natural Response
	greater extraction rates than for source control alone.	
4	**DEQ General Comments, Page 9** • Propose criteria for assessing the performance and effectiveness of the HC&C system and making adjustments to system operations.	As previously described, the requested criteria are proposed to be developed using the updated and calibrated MODFLOW model and described in the Operations Design Report.
5	**DEQ General Comments, Page 10** • Develop HC&C operational parameters (e.g., placing upper limits on extraction well pumping rates) and performance criteria (e.g., ranges of horizontal and vertical hydraulic gradient values in the Alluvium WBZ within which DNAPL mobilization is minimized) to achieve hydraulic containment but not exceed conditions that could mobilize DNAPL; and	For the reasons described in Appendix A, these operational parameters are proposed to be developed following testing of the extraction system and described in the Operations Design Report.
6	**DEQ General Comments, Page 12** Information available in the RI Report suggests NW Natural's estimate may be low. The RI Report indicates that during 2005, on an average daily basis 20,000 gallons of storm water and contaminated groundwater from the Fill WBZ were pumped out of the LNG tank basin, treated using granulated activated carbon, and discharged to the City of Portland publically-owned treatment works (POTW). The average daily removal rate corresponds to	NW Natural will be able to more accurately assess the potential flow into the planned interceptor trench after all of the extraction wells have been installed and the MODFLOW model is calibrated and updated. The updated estimate of flow into the interceptor trench would be provided in the Operations Design Report.

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	approximately 15 gpm. DEQ acknowledges the removal rate includes storm water, but notes the bottom of the LNG Basin is typically 2 to 7 feet below the water table in the Fill WBZ. Furthermore, the LNG Tank basin intercepts only a portion of the total groundwater moving through the Fill WBZ towards the river. Based on the information above and the magnitude of contamination in the surficial fill near the river, NW Natural should fully document estimates of groundwater flux through the Fill WBZ, including the magnitude and timing of seasonal extremes for purposes of verifying the anticipated total flow rate of 20 gpm.	
7	**DEQ Specific Comments, Page 4** • For clarification, DEQ considered simulations using March 27, 2000 data to be representative of a reasonable worst-case scenario where groundwater extraction rates and treatment system flow rates are concerned. The simulations were used in the source control planning and design process to further evaluate the potential maximum extraction rate and treatment flow rate of the HC&C system and treatment system respectively. The simulations completed for this purpose should not be represented as the reasonable worst-case scenario for all situations related to the performance of the HC&C system. For example, to assess seasonal maximum drawdowns in the upper Alluvium WBZ extraction wells would require	This type of predictive modeling to assess seasonal affects on drawdown would provide reliable data if it is conducted for the Operation Design Report, using the post-operational calibrated and updated MODFLOW model. Installation and testing of the extraction wells will provide the best information necessary to assess seasonal maximum drawdown.

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	using a different set of assumptions.	
8	**DEQ Specific Comments, Page 4** • DEQ understands Figure 3-2 is based on the March 27, 2000 water level data. NW Natural should indicate the extraction rates for each well or group of wells shown (e.g., upper Alluvium WBZ and lower Alluvium WBZ). NW Natural should also indicate whether operating the HC&C system under these conditions results in capture zones representative of the covering the minimum, average, or maximum lateral extent.	Yes, the extraction rate information used for design modeling can be provided in the Construction Design Report. However, the prediction of the lateral extent of capture zones would be more reliably developed in the Operations Design Report, using data obtained from testing the entire extraction system. Doing this type of predictive modeling will be more reliable after all of the extraction wells are installed, tested, and the model is updated and calibrated based on the new data.
9	**DEQ Specific Comments, Page 5** The results of ongoing transient MODFLOW simulations of the HC&C system should be included in the Draft Final Groundwater SCMs Design. DEQ's general comment on evaluating the long-term operations/effectiveness of the HC&C system also applies here.	Yes, as previously indicated the results of transient model runs will be included in the Operations Design Report.
10	**DEQ Specific Comments, Page 7** **Section 3.2.2.2.1, 1st paragraph page 29.** NW Natural indicates two factors were used to select the elevation of extraction well screens, including: 1) setting the screened intervals shallow enough to control vertical gradients and reduce the potential for DNAPL	Yes, this analysis was done using historic groundwater elevation data for the site and the specific capacity information from pump testing of the wells. For the Upper Alluvium wells the bottom of the intake screen was set no lower than the known depth of nearby

Category 2 Agency Requests to be addressed in Operations Design Report		NW Natural Response
	mobilization; and 2) placing the wells deep enough to provide sufficient available drawdown for the anticipated range of pumping rates needed for gradient control. To date, DEQ is not aware of NW Natural having actually compared the available drawdowns to the drawdowns predicted based on simulations of the long-term full-scale operation of the HC&C system. As indicated in DEQ's general comments on the long-term operation and effectiveness of the HC&C system, the Draft Final Groundwater SCMs Design should include such an evaluation under seasonal extremes of groundwater levels and river stage and NW Natural's recommended pump placements shown in Figure 3-7b. The comparison should also consider specific capacity estimates NW Natural derived from the extraction well tests previously conducted at the site.	DNAPL to facilitate the control of vertical gradients. This will be further explained in the Construction Design Report. As stated previously, a full review of the screen design will be conducted in the Construction Design Report. That work may conclude that some of the Upper Alluvium well screens should be lengthened. Predictions conducted now for full scale operation of the completed system would not necessarily be of limited use because the performance of future wells cannot be predicted with a sufficient degree of accuracy. To be of practical value, future analysis of this issue should be done using water level data from testing of the completed system and the results reported in the Operations Design Report.
11	**DEQ Specific Comments, Page 8** **Section 3.2.2.2.1, 2nd paragraph page 30.** DEQ requests NW Natural to evaluate adding upper Alluvium WBZ extraction wells at the PW-09 and PW-10 locations (i.e., PW-10U). DEQ believes these extraction wells may be warranted as: 1) the highest concentrations of free cyanide and total cyanide in the upper Alluvium WBZ are detected in the vicinity of the PW-09 and PW-10 locations; and 2) the response to pumping pilot extraction wells suggest the hydraulic influence of deep extraction wells on the upper Alluvium WBZ in	Yes, this request will be addressed in the Construction Design Report. NW Natural agrees that it is important to capture groundwater in the Upper Alluvium in this area and it is our full intent to do so. In the Construction Design Report, it will be made clear that the system is designed to accommodate the implementation of contingency measures, such as the addition of extraction wells, if needed. However, it is NW Natural's recommendation to install the system as

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	this portion of the site may be less than previously thought.	it is currently designed and test the complete system. That data would then be used to do a capture analysis in the Operations Design Report to determine if extraction wells in the Upper Alluvium are needed in this area.
12	**DEQ Specific Comments, Pages 9 and 10** **Section 3.2.2.5.2, 6th and 7th paragraphs.** According to NW Natural, the programmable logic control (PLC) is designed so a unique elevation delta (ΔH) can be assigned to each control well transducer. DEQ understands ΔH represents the elevation difference between the river and groundwater elevation in the control well. In other words, the delta value controls the magnitude of the hydraulic gradient between the river and the HC&C control wells. The higher the ΔH in a control well, the greater the pumping rate needed at the corresponding extraction well. DEQ further understands ΔH is a critical design parameter whose value must be equaled or exceeded at control wells on an average basis for the HC&C system to be effective. As such, ΔH values should be selected to ensure the HC&C system maintains gradient reversals throughout the full thickness of the Alluvium WBZ. NW Natural indicates recommended ΔH values will be provided during the startup process. However, operation of the HC&C	As stated previously, it is possible to select the ΔH value as requested by DEQ and to use the MODFLOW model to predict the gradients needed for capture. However, such predictive modeling will not be useful because 17 of the 22 planned extraction wells have not been installed or tested. The water level data that will result from pumping those wells cannot be accurately predicted until the wells have been field tested. This type of analysis is recommended to be done based on testing the entire extraction system and the results provided in the Operations Design Report. For clarification, we actually do not need gradient reversal throughout the aquifer—just strong enough inward gradients in the shallow and intermediate wells for deep groundwater to flow to the wells instead of the river.

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system can be modeled using MODFLOW and the gradients needed to fully contain the Alluvium WBZ can be estimated based on the simulated head differences between uplands installations and the river. DEQ requests the anticipated range of ΔH values be provided in the draft final design document as projected performance criteria, refinement of which will be performed during start-up. DEQ expects the ΔH values to be selected to account for and overcome factors not related to operating the extraction wells (e.g., fluctuations caused by river stage, "drift" in transducer readings).	
13 **EPA Specific Comments** 2. Section 3.1.3, page 13, paragraph 1, 5th sentence: There does not appear to be supportive analysis to provide a basis for the assumption that when a well is shut down for maintenance, other adjacent wells will be capable of increasing their pumping rates to maintain capture. To fully support this assumption, NW Natural should evaluate this analytically and using specific capacities, available drawdown, well yields necessary for capture as derived from modeling simulations, and Segment 2 constant-rate and VFD testing. Based on a preliminary review of available drawdown at current conditions, sustainable extraction rates in the upper alluvium wells are greatly limited with no additional capacity to increase pumping rates to support the loss of an adjacent shutdown well.	Yes, this type of analysis will be done and provided in the Operations Design Report.

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14 EPA Specific Comments, item 8 8. Section 3.2.1.4, page 21, last paragraph: NW Natural states that the model was not modified to reflect the numerous slug test results that indicate the Fill WBZ has an average hydraulic conductivity of less than 1 ft/day. Rather, NW Natural maintained a 10 ft/day assignment to the Fill WBZ in the model. The justification for this is the observation that the model calibrated well using the higher hydraulic conductivity and that a higher hydraulic conductivity assignment is more conservative from the standpoint of determining flow to the proposed interceptor trench and sizing of the pump and treat system. However, EPA believes a sensitivity analysis is needed to assess the degree of influence the lower hydraulic conductivity will have to the extraction system design. Since model simulations will be used to evaluate capture of groundwater at assigned flow rates, the extraction wells currently may show higher than actual pumping capacities as a result of higher recharge assigned in the model. NW Natural should re-run model simulations at hydraulic conductivities determined from site data and with the additional design elements (interceptor trench, paving, etc.) to re-evaluate extraction well placement, capacity limitations, and overall design.	For reasons explained in Appendix A, this type of predictive modeling is proposed to be completed after the extraction system has been installed and pump tested. The findings would be provided in the Operations Design Report, along with design changes or recommendations for contingency measures, if any. The concern that the current design may be based on higher than actual flow rates is unwarranted. NW Natural prefers to have a system that may have too much capacity than one that is inadequate.

Appendix B
Gasco Source Control Design Report
Category 2 Responses to Agency Requests

Category 2 Agency Requests to be addressed in Operations Design Report	NW Natural Response
15 EPA Specific Comments, item 13c c. No analysis of how this intercepted fill water, that naturally recharges the Upper Alluvium, will affect the sustainability (available drawdown) of the Upper and Lower Alluvium extraction wells. Analytical and/or numerical modeling simulations should be prepared to evaluate this potential impact.	The current MODFLOW model does not assume that the Fill WBZ recharge is reduced from paving of the site. Therefore, a revised model that assumes paving is present would reduce the recharge to the Fill WBZ and reduce the modeled downward infiltration to the Upper Alluvium. This would reduce the amount of groundwater that has to be removed by the Upper Alluvium wells, so the current model is conservative with respect to the potential paving.

Appendix B
Gasco Source Control Design Report
Category 3 Responses to DEQ and EPA Comments

Category 3 Responses to Agency Requests		NW Natural Response
1	**DEQ General Comments, pages 6 and 7** Regarding the last two bulleted items, given source control design is ongoing and the uplands FS has not been initiated, DEQ believes a reasonable goal for coordinating source control design and FS planning is to complete the Risk Assessment and final SCMs design within a similar timeframe.	NW Natural believes that construction of source control is a time critical project need, and it has been a NW Natural corporate priority for years. We do not think source control implementation should be delayed for any reason. DEQ's decision to prioritize source control oversight and postpone its review of the Gasco risk assessment for five years has resulted in separate implementation schedules. NW Natural agrees that the risk assessment should be finalized as soon as possible so the Upland FS can be initiated.
2	**General Comments, Page 11** As indicated in DEQ's March 10, 2010 letter commenting on the RI Report and Risk Assessment, NW Natural should conduct additional soil and groundwater investigations in the northern portion of the NW Natural Property to: 1) delineate the nature and extent of MGP contamination in soil and groundwater; 2) evaluate the occurrence and direction(s) of groundwater flow in the Fill WBZ and Alluvium WBZ; and 3) characterize the concentrations of MGP COI in soil and groundwater migrating from the NW Natural to offsite areas, including the U.S. Moorings site. The scope of work for these investigations should include drilling and installation of monitoring wells in the Fill WBZ and Alluvium	NW Natural's past position has been to conduct the U.S. Moorings component of source control on a separate track. Our concern is that DEQ may now require that the two efforts become concurrent. The additional site characterization that is needed on the north end of the Gasco site and on the U.S. Moorings site would cause an unacceptable delay to the overall source control project. The existing design of the interceptor trench and extraction well system could be supplemented in the future, with additional trench length and extraction wells, if needed, to accommodate conditions on the U.S. Moorings site.

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	WBZ. Based on the data collected by the ACOE and NW Natural, the results of this work could indicate contaminated groundwater is migrating offsite to the north and discharging to the river via the U.S. Moorings site. As such, groundwater sampling in the northern portion of the NW Natural's property could influence the groundwater SCMs design along shoreline Segment 2 (e.g., result in lengthening the interceptor trench; the addition of extraction wells in the Alluvium WBZ). NW Natural should fully discuss the scenario involving the U.S. Mooring site in the context of the groundwater SCMs design for the fill and Alluvium WBZ and the sequence and timeframe for conducting the additional soil and groundwater investigations.	
3	**DEQ General Comments, Pages 12 and 13** **Potential Limitations on Uplands SCMs and/or Riverbank Alternatives.** As DEQ indicated in the March 21, 2008 letter regarding the Groundwater/DNAPL FFS, planning, design, and implementation of the uplands SCMs must take into consideration future riverbank work, including but not limited to bank repair, stabilization, and/or excavation, removal, and replacement. DEQ continues to maintain construction of the riverbank remedy should not interfere with the uplands SCMs, which now includes the Fill WBZ interceptor trench, the Alluvium WBZ HC&C system, and the treatment system and its associated equipment, buildings, and piping. Likewise, uplands SCMs should not limit NW Natural's	We agree, with the understanding that "maximum flexibility" will be defined by standard feasibility study factors, such as implementability and cost effectiveness. For example, we do not believe that DEQ's current request to move the interceptor trench is an example of maximum flexibility to an existing design. Maximum flexibility is a concept that applies to adjustments to major design elements that result in increased efficiency and effectiveness instead of wholesale revisions. Moving the Fill trench is not considered an example of flexibility because it is likely not feasible on Siltronic property, and conducting a

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	ability to implement effective remedial alternatives to address the riverbank. Implementation of groundwater SCMs should satisfy two conditions: 1) the interceptor trench and HC&C system should preserve maximum flexibility in accommodating the range of options for remediating bank soil and river sediment, and 2) future riverbank work should not interfere with construction of groundwater SCMs or compromise groundwater SCMs during riverbank sediment remedy construction.	geotechnical investigation creates an unacceptable delay to the overall source control project.
4	**DEQ Specific Comments, Page 6** For purposes of groundwater source control planning and design, compiling information regarding DNAPL occurrence on geologic cross-sections is intended to support HC&C system design and development of the performance monitoring program, not better understand DNAPL distribution as NW Natural suggests. As such, the consistency and accuracy of the methods used to interpret DNAPL occurrence is less important than assessing the potential distribution of DNAPL relative to extraction wells and performance monitoring wells. The figures should be reviewed, revised, and resubmitted for the Draft Final Groundwater SCMs Design. Alternatively, a set of cross-sections modified per DEQ's comment could be prepared for this purpose and attached as an appendix.	NW Natural believes that consistency and accuracy of methodology are crucial and reasonable criteria to apply in any evaluation of data. We continue to have strong concerns and reservations over DEQ's requests that visual observations of sheen from boring logs be added to cross sections as evidence of DNAPL. The comment allows the development of a separate set of cross sections to be included as an attachment, rather than being included as main figures in the design report. We agree to develop these cross sections; however, we will not label sheen as DNAPL. The cross sections will differentiate between those two very distinct and different visual observations. This information has been available to DEQ in a variety of

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DEQ previously requested the figures be updated as discussed above in letters dated August 22, 2008 and March 26, 2010, and during meetings on February 3rd and March 3, 2011. As indicated in the General Comments, DEQ considers this a key issue for a developing the performance monitoring plan for DNAPL.	forms for years. As such, we do not believe these cross sections will provide any new basis for redefining the extent of DNAPL, and we do not agree that presence of sheen should be used as evidence of DNAPL migration during future performance monitoring.